Vitalab Flexor E Service Manual 6002 - 190 - 450

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Preface

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This manual was written and reproduced with the utmost care. However, errors cannot be fully excluded. Vital Scientific N.V. does not take any responsibilities and accepts no liabilities for incidents of any kind that may occur because of errors in the manual.

All products names that are mentioned in this manual are registered trademarks.
The manual describes the analyser system Vitalab Flexor E.

The Vitalab Flexor E was conceptualised, manufactured and tested in accordance with the declaration of conformity. The declaration of conformity is supplied with each device in a separate file.

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This manual was conceptualized, written and layouted by Vital Scientific N.V.

1 GENERAL

1.1 INTRODUCTION

The instrument has been designed as a fully selective Patient Orientated Analyser system. The chemistries include kinetic, two-point and endpoint determinations with both linear and non-linear calculation modes.

The instrument has two modes: mono mode for running mono reagents and dual mode for dual reagents. The mono-reagent mode has a maximum throughput of 180 tests/hour. The dual-reagent mode has a maximum throughput of 133 tests/hour.

1.2 SCOPE AND ORGANIZATION

This Service Manual is part of a two-volume set.
The Instruction Manual is the first part of this set.

The Instruction manual provides detailed operating instructions, technical specifications and some brief trouble shooting instructions.

The Service manual has been prepared for service technicians and other technical personnel directly involved in maintaining and repairing the instrument.

The reference information is provided in 10 separate sections.

Section 1: General

This section provides general information about the service and repair policy, warranty, spare parts, technical assistance and service trainings.

Section 2: Functional design

This section provides information about the functional design of the analyser.

This includes a short description of the functional units like sample rotor, washing unit, monitor etc., a description of the mechanical and optical design, and the fluid system.

Section 3: System organisation

This section describes the system organisation of the instrument that includes the theory of operation and the design of the different electronic circuits.

Section 4: Installation & Maintenance

This section provides instructions for installation and maintenance of the instrument, and test diagnostics.

Section 5: Mechanical adjustments

This section describes the procedures for mechanical adjustments.
The assembly/disassembly instructions are included as well.

Section 6: Electrical adjustments

This section describes the electrical adjustment procedures.

Section 7: Error handling

This section contains the error handling and a comprehensive procedure for trouble shooting. A consolidated list of necessary support equipment can also be found in this chapter.

Section 8: Electrical diagrams

This section provides all the relevant electrical diagrams, PCB assemblies, electrical component part lists and wiring diagrams.

Section 9: Mechanical drawings

This section provides the mechanical drawings, part lists, and facilitates the identification and ordering of service parts.

Section 10:

This section is initially left blank but is meant for service information regarding the analyser.

1.3 REPAIR POLICY

Refer to the section “General conditions of sale” in the Price List for the general repair policy.

1.4 WARRANTY

Refer to the section “General Conditions of Sale” in the Price List for the general warranty policy.

1.5 SPARE PARTS

Refer to the section “General Conditions of Sale” in the Price List for the general spare parts policy.

1.6 TECHNICAL ASSISTANCE

Should you encounter a problem that requires technical assistance, you may call, fax or email the Service Department of Vital Scientific.
Please be prepared to give a clear and complete description of the problem.
Also be prepared to give an answer to the following questions:

- type of instrument
- serial number
- software version (when applicable)
- revision level (in case of a PCB)

1.7 SERVICE TRAINING

Service training courses are organised on a regular base. Information is available from the Sales department of Vital Scientific. In principal courses will be held at Vital Scientific, but in consultation it is possible to organise a course at the customers site.

Participants are expected to have knowledge of:

- analog / digital electronics
- microprocessor techniques
- basic photometric techniques
- the English language

Please contact the Service Department of Vital Scientific for information about service trainings.

1.8 FIELD SERVICE INFORMATION

The purpose of the Field Service Information system is to provide detailed information on the frequency and nature of failures that occur during field use.

This information enables us to take corrective actions and to improve on the design and manufacturing methods.

For this purpose we have designed two different forms:

- Installation report
- Malfunctioning report

The Installation report should be filled-out when the instrument is installed at the customers' site.

The malfunctioning report should be filled-out each time when a service action is performed on the instrument.

We request you to return the filled-out forms to us on a regular base (for example once a month) by mail or fax, whatever is convenient.

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All product names that are mentioned in this manual are registered trademarks. The manual describes the analyser system Fibron I and its software version 1.0 (November 2002).

The Fibron I is conceptualised, manufactured and tested in accordance with the declaration of conformity. The declaration is supplied with each device in a separate file.

Please call your local distributor if you need advice or you have any questions.

Article No: 6002-500-450

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TABLE OF CONTENTS

SAFETY PRECAUTIONS AND POTENTIAL HAZARDS ____ 2

- GENERAL ____ 2
- OPERATOR QUALIFICATIONS ____ 2
- SERVICE TECHNICIAN QUALIFICATIONS ____ 2
- DESCRIPTION OF SYMBOLS ____ 2
- ELECTRICAL ____ 3
- MECHANICAL ____ 3
- CHEMICAL ____ 3
- BIOHAZARDOUS MATERIALS ____ 3
- SAMPLES ____ 3
- WASTE SOLUTION AND SOLID WASTES ____ 4
- BIOHAZARDOUS PARTS ____ 4
- ADDITIONAL PRECAUTIONS ____ 4
- FLAMMABLES ____ 4
- ACCURACY/PRECISION OF MEASURED RESULTS ____ 4
- APPLICATION ____ 4
- INSTALLATION REQUIREMENTS ____ 5
- INSTRUMENT UNUSED FOR A LONG PERIOD OF TIME ____ 5

ERROR HANDLING ____ 6

PARTS-OVERVIEW ____ 8

PARTS LIST ____ 10

Safety precautions and Potential hazards

General

Before you start installing and working with the analyser, you should read the safety precautions and regulations detailed in this chapter. Safety comes first!

Operator Qualifications

- Operation should be conducted under the management of a technician/operator who has undergone training at the facility specified by the sales agent.
- For clinical tests, the instrument should be used under the management of a doctor or clinical inspector.

Service Technician Qualifications

To install, maintain and repair the instrument, a service technician has to be trained in the use of the instrument by the manufacturer or their representative. A service technician is also expected to be familiar with the normal and special operations of the instrument as described in this User's Manual.

Description of Symbols

This means that the labelled item could lead to personal injury and/or damage to the analyser.

Note:

Notes contain additional information corresponding to the text.

Electrical

Please pay attention to the following items:

- To prevent the risk of electrical shock and/or damage to the instrument **Operators** should not open the top cover of the instrument. Only authorised personnel, for example, **service technicians,** may open the instrument to perform maintenance or repair.
- Don't touch the main board when the power is on as this may cause severe injury or death.

Mechanical

There is no risk presented by the mechanical parts of the instrument when the covers are closed. If the covers of the instrument are removed, mechanical parts could cause personal injury if touched or become damaged. Therefore, the following advice must be followed: DO NOT wear loose garments or jewelry that could catch in mechanisms. DO NOT put your fingers/ hands into the path of any part while the analyzer is in operation. DO NOT attempt to make mechanical repairs unless the instrument is not in operation or turned OFF.

Chemical

The operator is responsible for taking all necessary precautions against hazards associated with the use of clinical laboratory chemicals. Specific recommendations for each reagent used with the analyser are normally found on the manufacturer's package inserts or on product information sheets for each chemical. Wipe away any reagent spillage on the instrument immediately.

Biohazardous Materials

As with all in vitro diagnostic equipment, patient samples and serum-based quality control (QC) products that are assayed on this system, as well as all waste from the waste container, should be treated as potentially biohazardous. All materials and mechanical components associated with the sampling and waste system should be handled according to your facility's biohazard procedure. Use the personal protective equipment recommended by your facility when handling any of these components.
Detailed recommendations:

Samples

Treat all samples as potentially biohazardous and infectious. If any sample is spilt on the instrument, utilise the correct personal protective equipment (PPE-gloves, lab coat, etc.), wipe it away immediately and clean the contaminated surface with a disinfectant.

Waste Solution and Solid Wastes

- Avoid direct contact with waste solution and/or solid waste. Both should be handled as potentially biohazardous.
- Dispose of waste solution and/or solid waste according to the relevant governmental regulations.
- Consult the reagent manufacturer for information on the concentrations of heavy metals and other toxic constituents in each reagent.

Biohazardous Parts

- Avoid direct contact with all parts of the sample-area. Treat these areas as potentially biohazardous and/or infectious.
- Avoid direct body-contact with reagents. Direct body-contact may result in irritation or damage to your skin. Refer to the manufacturer's reagent kit box and package inserts, or product information sheets for specific instructions.
- Avoid direct body-contact with cleaning solutions. Direct body-contact may result in skin irritation or damage. Refer to the manufacturers kit box and package inserts, or product information sheets for specific instructions.

Additional precautions

Flammables

Avoid using dangerous flammable material around the instrument. Fire or explosion may be caused by ignition.

Accuracy/Precision of Measured Results

- For proper use of the instrument, measure control samples and monitor the instrument during operation.
- An incorrectly measured result may lead to an error in diagnosis, thereby posing a danger to the patient.
- Treat all reagents according the manufacturer's recommendations. Refer to the reagent kit box and package inserts, or product information sheets for specific instructions.

Application

- The Fibron-1 is a single channel coagulometer that works on the principle of photometric clot detection. The detection of the coagulation end point is achieved by measuring the change in optical density of a plasma/reagent sample.
- Please note that other types of analyses may not be applicable to this instrument.

- Operation and Maintenance of the analyser should be performed in accordance with the instructions in this manual.
- During operation and maintenance of the instrument, proceed according to the instructions and do not touch any parts of the instrument other than those specified.
- Always clean the instrument after a batch of measurements
- Ensure that both the covers are closed when the instrument is in operation.
- Avoid touching the instrument inside while the instrument is operating. This may cause operation to stopped or damage the instrument.

Installation Requirements

Installation should only be performed by a representative of the instrument's manufacturer. The customer is responsible for providing the necessary facilities as detailed in chapter "Technical Data" in this User's Manual

Instrument Unused for a Long Period of Time

If the instrument is not due to be used for a long period of time, ensure that it is thoroughly cleaned . Place the dustcover over the analyzer to prevent dust from entering the analyzer.

Maintenance:

There is no periodic maintenance

The customer should run their internal quality control on a regular basis.

Error handling

Error “Inadequate light”. Only when this error appears with every sample, the following steps should be followed

Check the red LED.

If the LED is off and the heating and display are working, replace the LED board (pn: 6002-513)

If the LED is on, check the light level by using the hidden menu and check if the parameters are ok. The light level should be close to 41000 when there is no cuvette in the lightpath. The gain setting can be adjusted by using the **[<]** and **[>]** key’s.

To get into the hidden menu:
Switch on the instrument. When the first screen appears (Vital Scientific) press first **[<]** and immediately **[>]**
Always go to the next screen by using the [ENTER] key until the instrument tells you to restart the Fibron (By switching off and on again)

The following numbers should be in there:

Light level:	± 41000 Gain xx
PT threshold:	37
APTT threshold:	25
Open threshold:	37
Auto start threshold :	512
Number Count:	4

If the lightlevel can not be adjusted, replace the detector board (pn: 6002-514)

Error “excessive light”. Only when this error appears with every sample, the following steps should be followed

Check the light level in the hidden menu. See above for the numbers

If the lightlevel can not be adjusted, replace the detector board (pn: 6002-514)
If this does not solve the problem, replace the main board (pn: 6002-511)

If the instrument does not stat-up

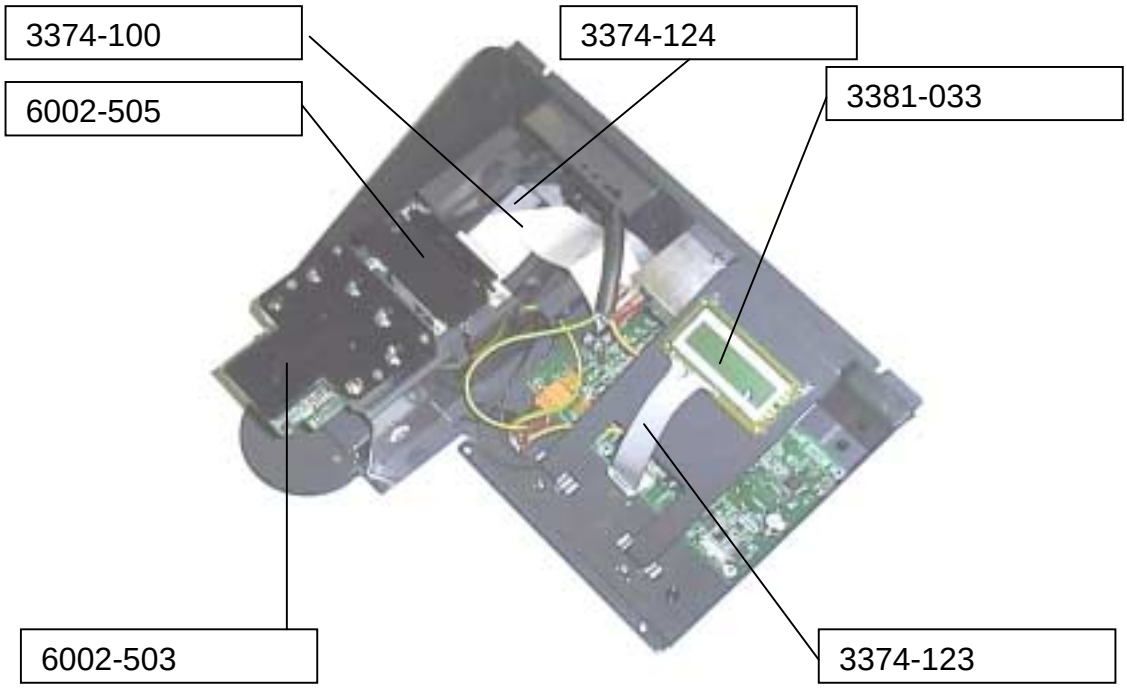
When the instrument does not start-up, check the fuses at the line entry, if this is ok, check the voltage on the orange connector on the main board. This should be 4.85 to 5.15 V. If this is not ok, remove the cover over the power-supply and check the fuse and if necessary adjust the voltage using the potentiometer (SVR1) in the left front corner. If this fuse is ok, but the power is not adjustable, replace the power-supply (pn:3359-045). If this does not solve the problem replace the main board(pn:6002-511)

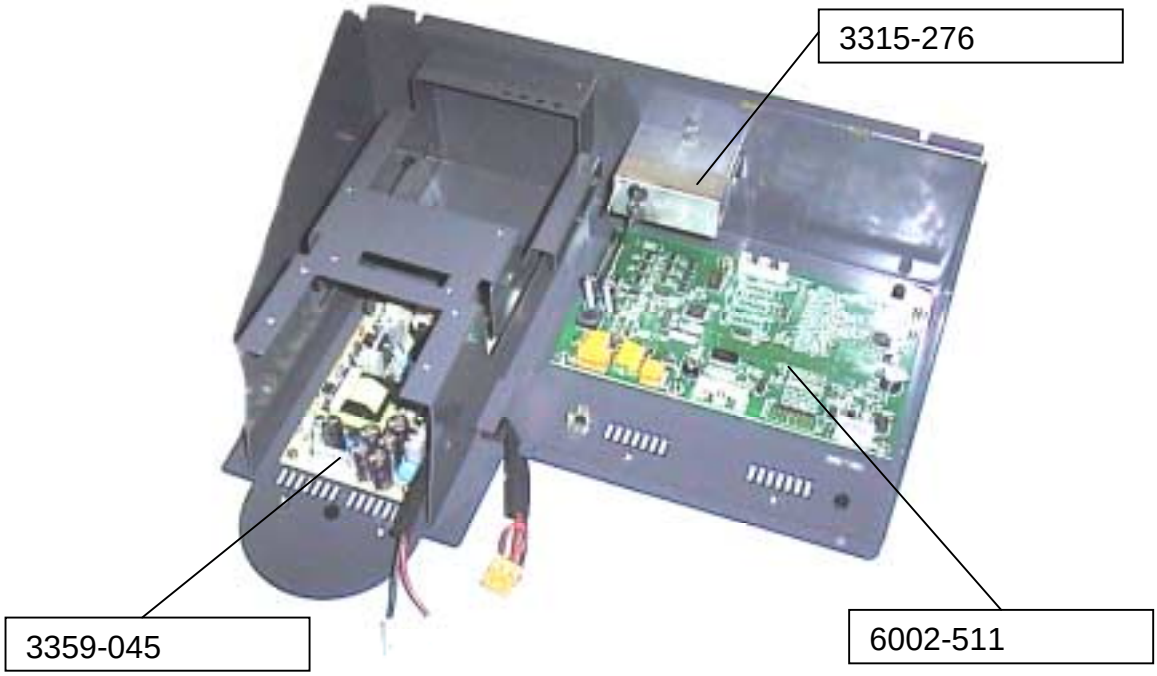
In all case of replacing one of the boards, always check the settings in the hidden menu and set them as follow:

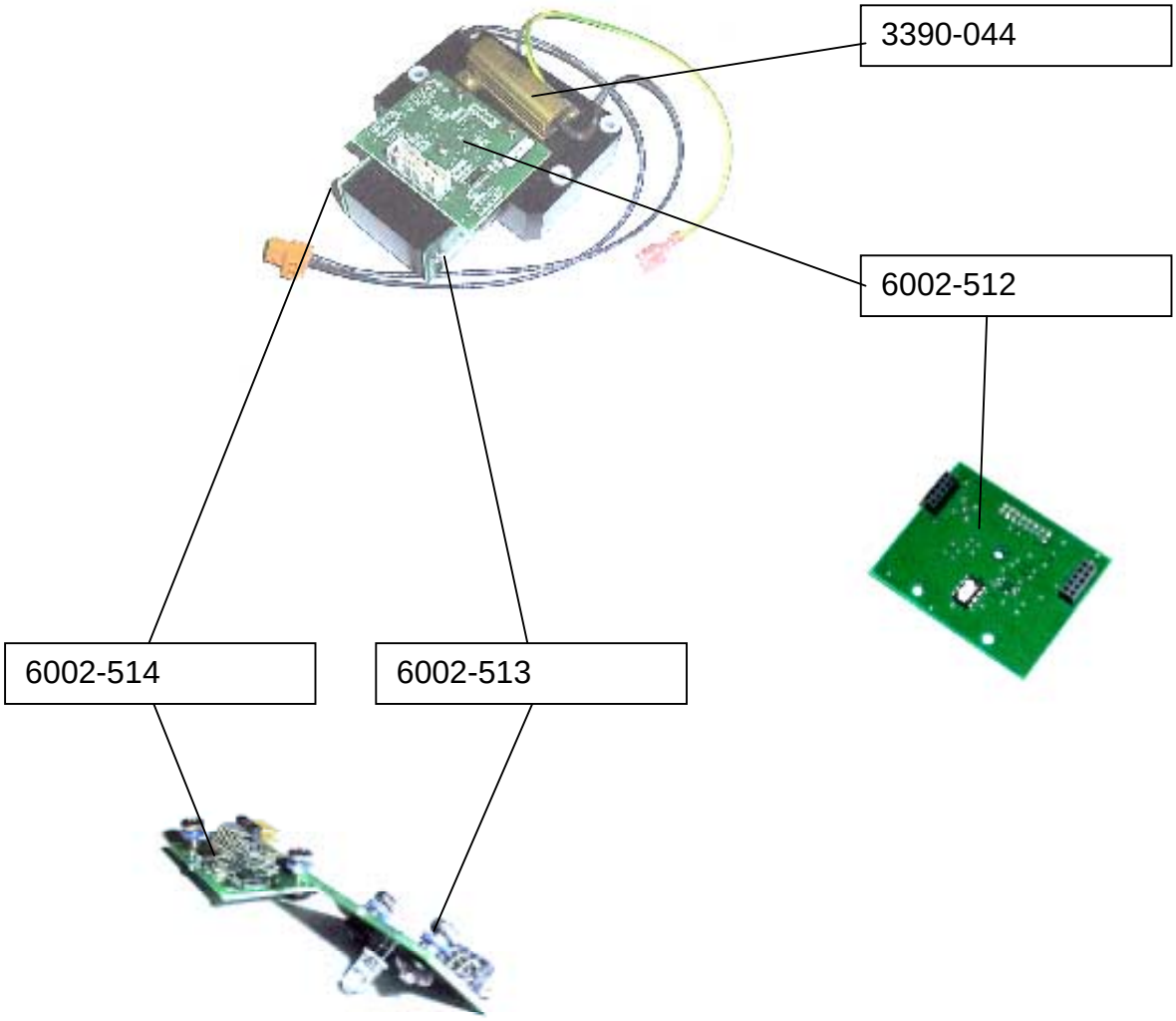
Light level:	± 41000 Gain xx
PT threshold:	37
APTT threshold:	25
Open threshold:	37
Auto start threshold:	512
Number Count:	4

When setting these numbers, always move to the next screen by pressing [ENTER] until you get to the screen “Reset Fibron” Then switch off and on the instrument by using the main switch.
(Only when entering **all** system settings these will be stored)

Parts-overview






3390-044
6002-512
6002-514
6002-513

Parts List

3315-276	Line filter 250/110
3342-857	Key pad
3359-045	Power supply
3374-100	Printer cable
3374-123	LCD flat cable
3374-124	Detector cable
3381-033	LCD module
3390-044	Power resistor 1.5 (heater)
6002-503	Incubator unit
6002-505	Printer unit
6002-511	Main board
6002-512	Temperature board
6002-513	LED board
6002-514	Detector board

2.1 FUNCTIONAL UNITS

2.1.1 INTRODUCTION

In the figure below you find an overview of the main functional units of the analyser.

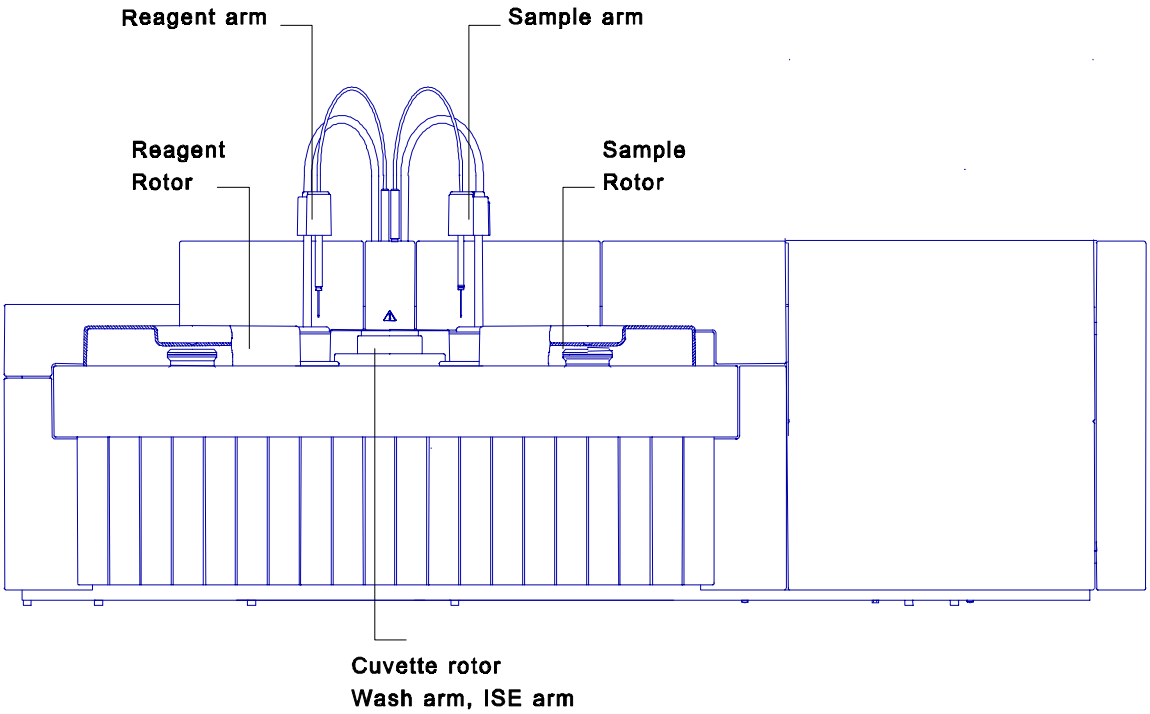


Figure 2.1 – Overview of the analyser

2.1.2 SAMPLE ROTOR

The various instruments can have different sample rotors.
Refer to the special pages for the various machines for the right rotor.
A stepper motor drives the rotor.

2.1.3 REAGENT ROTOR

There are 24 positions for 25 ml bottles and 8 positions for 7 ml bottles in the reagent rotor. Some openings for 25 ml bottles can be combined to fit 50 ml bottles.
Adapters for a placing a 7ml bottle on a 25 ml position are also available.
All positions can be assigned as Reagent 1 or 2 (start reagent)
The reagent disk compartment can be cooled by an external cooling unit.
A stepper motor drives the reagent rotor.

Some instruments have an optional special reagent rotor.

2.1.4 SAMPLE ARM

The sample needle aspirates a programmed volume and will dispense it into a cuvette of the cuvette rotor. After pipetting, the sample needle mixes the reaction mixture. After sampling and mixing the needle will be washed inside and outside.

Because the sample arm has to move in two directions, two stepper motors; horizontal and vertical drive the sample arm. The sample arm is equipped with a level detector that will detect the liquid level of the sample cup and will generate an error message when not enough sample is present in the cup.

2.1.5 REAGENT ARM

The reagent needle will aspirate a programmed reagent volume and will dispense it into a cuvette of the cuvette rotor. After pipetting (reagent 2) the reagent needle will mix the mixture in the cuvette. Then the needle will be washed inside and outside.

The reagent arm must be able to move in two directions and is therefore driven by two stepper motors. The reagent arm is equipped with a level detector to check if sufficient reagent is present. It is also equipped with a controlled heating element to preheat the cooled reagent.

2.1.6 ISE ARM

Optionally the instrument is equipped with an ISE-arm to connect the instrument to an optional external ISE (Ion Selective Electrode) measuring unit.
This external ISE unit is controlled by the instrument and the ISE arm aspirates sample from the cuvette rotor. The ISE arm is integrated in the mixer unit.

2.1.7 PIPETTORS

The two Hamilton syringes, a 1000 µl and a 100 µl type, are used in combination with two valves for reagent and sample pipetting.
The pipetting system is water filled with air bubble separation.
A stepper motor drives each syringe, and the detection of the syringe up and down positions is done by opto-switches.

2.1.8 CUVETTE ROTOR

The cuvette rotor contains 48 cuvettes, which are thermostatted at 37 °C.
The path length of a cuvette is about 7mm, but absorbance values are re-calculated to 10 mm path length. A stepper motor drives the cuvette rotor.

The heating of the cuvette rotor is done by means of two controlled Peltier elements.

The cover of the cuvette rotor is equipped with a heating element to avoid condensation at the inside of this cover.

2.1.9 WASHING UNIT

The washing unit washes the cuvettes after usage. At the first 4 positions of the washing unit a long needle aspirates the cuvette contents and a short needle fills the cuvette with water. At the fifth position the water is aspirated, at the sixth position a drying block dries the cuvette.
With the option concentrated waste installed the liquid aspirated at the first cleaning action (i.e. the reaction mixture) is lead to the concentrated waste deposit.

The washing unit is equipped with liquid sensors to detect flooding of the cuvette.

2.1.10 COOLING UNIT

Cooling of the reagents is done by means of an external cooling unit.
This unit keeps the cooling liquid in the container at a fixed temperature, which must be set at the cooling unit.

On its turn the cooling liquid is pumped through a heat exchanger in the analyser where cool air is fed through a closed reagent compartment.

2.2 TIMING PRINCIPLE

The instrument always works with a fixed cycle time. In this fixed cycle all the necessary dispensing, mixing, washing and diluting take place and also a fixed number of measurements are made, regardless if they are necessary or not.

This fixed cycle assures that all the necessary measurements for a test always take place at the right moment. Even if no measurements have to be taken (for example during washing of the first cuvettes) the cycle takes place. In that case the reading of the photometer is ignored.
There are two operating modes, the Mono Mode, for single reagent use, and the Dual Mode, where a second reagent can be used. The user can switch over from the Mono Mode to the Dual Mode, but not during testing. After switching from one mode to the other the instrument will reset.

2.2.1 MONO MODE CYCLE

The Mono Mode has a cycle time of 20 seconds, so the theoretical throughput of the instrument is 180 tests/hour (3x60). In practice the throughput is a little less, due to possible sample blanks and the start-up time which is 13 minutes.

In the figure below you find a graphic representation of the 20-second cycle.
The line represents the cuvette that starts at the sample dispensing position.

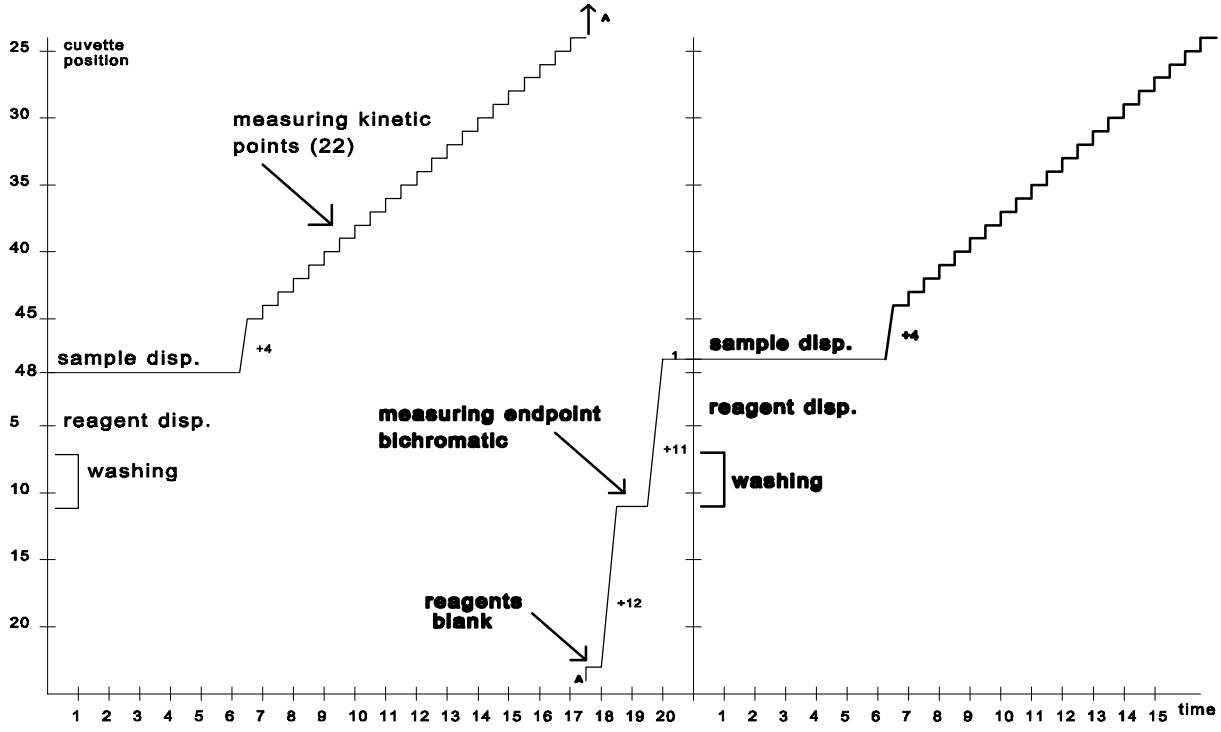


Figure 2.2 Graphic representation Mono cycle

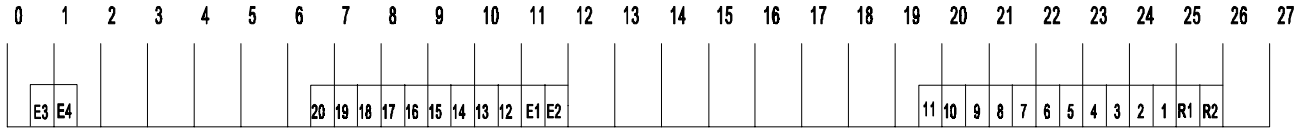
Note that after every cycle the cuvette rotor shifts one position.

As a result of this cycle after 48 cycles all cuvettes have been washed, pipetted and measured. In the table you will find the order of actions for the individual cuvettes:

Action	Time (sec)	min : sec
Washing of the cuvette	-120 to –70	
Reagent dispensing	-50	
Reagent blank	-10	
Sample addition and mixing	0	00:00
K 1 (measuring kinetic point 1)	12	00:12
K 2	32	00:32
Sample aspiration for ISE		
K 3	51	00:51
K 4	70	01:10
K 5	90	01:30
K 6	110	01:50
K 7	129	02:09
K 8	148	02:28
K 9	168	02:48
K 10	188	03:08
K 11	207	03:07
K 12	226	03:46
K 13	246	04:06
K 14	266	04:26
K 15	285	04:45
K 16	304	05:04
K 17	324	05:24
K 18	344	05:44
K 19	363	06:03
K 20	382	06:22
K 21	402	06:42
K 22	422	07:02
Endpoint measurement (Bichromatic)	690	11:30

2.2.2 DUAL MODE CYCLE

The cycle time of the Dual Mode is 27 seconds, therefore the theoretical throughput of the instrument is 133 tests/hour.
In the figure below the sequence of the 27 seconds cycle is shown.



E1, E2 = Endpoint dichromatic after 4.5 minutes

E3, E4 = Endpoint dichromatic

R1, R2 = Reagent Blank dichromatic

Figure 2.3 - The 27-second cycle

Because in the Dual Mode use can be made of a second (or starter) reagent in this cycle there is time for the second reagent to be dispensed and mixed.

Instead of dispensing a second reagent, these extra 7 seconds can also be used for predilution of a sample. In case of predilution, in one cycle the sample is added to the diluent, and in the next cycle (in the extra 7 seconds) the diluted sample is picked up by the sample needle and dispensed in the next cuvette, which already contains the appropriate reagent.

The table below shows the timing in the dual mode for each individual cuvette

Action	Time after sample addition	Time after Reagent 2 addition
Washing of the cuvette		
Reagent 1 dispensing	-135	
Reagent blank (Bichromatic)	-3	
Sample addition and mixing	00:00	
K 1 (measuring kinetic point 1)	00:24	
K 2	00:50	
Sample aspiration for ISE	00:54	
K 3	01:17	
K 4	01:43	
K 5	02:10	
K 6	02:36	
K 7	03:03	
K 8	03:29	
K 9	03:56	
K 10	04:22	
K 11 / Blank before adding reagent 2	04:40	
dispensing reagent 2 and mixing	04:43	00:00
K 12	04:49	00:06
K 13	05:07	00:24
K 14	05:33	00:50
K 15	06:00	01:17
K 16	06:26	01:43
K 17	06:53	02:10
K 18	07:19	02:36
K 19	07:46	03:03
K 20	08:20	03:29
K 21	08:39	03:56
Endpoint measurement (Bichromatic)	11:15	

2.3 MECHANICAL DESIGN

2.3.1 REAGENT ARM

The reagent arm is responsible for the moving of the reagent needle to the correct position. The construction of the arm is such that the driving for the movements is decoupled; separate stepper motors drive the up/down movement and the sideward-rotating movement.

The reagent arm has in fact seven discrete horizontal positions in which the arm normally is positioned. A reset opto and a subsequent number of stepper motor steps determine these positions.

Horizontal: Cuvette position
Wash position
5 * Reagent Rotor position

There are three discrete vertical positions and one variable vertical position:

Vertical: Up (or reset) position
Cuvette position
Wash position
Reagent (variable value, depending on the liquid level in the reagent bottle

For the discrete positions a value will be assigned with respect to the reset position, which will comply with the number of steps the stepper motor needs for the arm to reach its destination.

The variable position for the reagent level indicates the arm to lower itself just below the reagent level in the bottle (enough to aspirate 400 µl).
This position is determined by a level detection and the subsequential lowering with a predefined number of steps.

2.3.2 SAMPLE ARM

The sample arm is responsible for moving the sample needle in the correct position. The construction of the arm is such that the driving for the movements is decoupled; separate stepper motors drive the up/down movement and the sideward-rotating movement.

The sample arm has five discrete horizontal positions, which are represented by five stepper motor co-ordinates:

Horizontal: Cuvette position
Wash position
Sample rotor outer position
Sample rotor middle position
Sample rotor inner position

In the vertical direction there are three discrete and one variable position:

Vertical: Up or reset position
Cuvette position
Wash position
Sample position (variable position, depending on the sample volume)

2.3.3 REAGENT AND SAMPLE ROTOR

The reagent rotor has 32 discrete positions that correspond with the 32 reagent bottle positions, although optional different reagent rotors are possible.

The sample rotor has 72 discrete positions that correspond with the 72 sample cup positions.

2.3.4 MEASURING UNIT

The measuring unit consists of the following items mounted together as one unit:

- measuring rotor
- filter wheel with lamp unit

The measuring rotor is stepper motor driven and the reset position is detected by an opto-switch.
The measuring rotor has 48 discrete positions that correspond with the 48 cuvettes which must be positioned in the lightpath. Since a full turn of the stepper motor is 2400 steps, the distance between two cuvettes is 50 steps.

Two Peltier elements are mounted under the measuring rotor to heat the cuvettes.
The selection of the wavelength is done by means of an 8-position filter wheel.
The standard mounted filters are 340, 376, 405, 436, 505, 546, 578, and 620 nm.
The filter wheel has 8 discrete positions that are 48 steps away from each other.
The reset position is detected by an opto-switch.
The lamp unit consists of a lamp holder with a mechanism for adjusting the lamp.

2.3.5 WASH UNIT AND BELLOWS PUMP

The wash unit is built up with a stepper motor that is driving via a timing belt the wash arm.

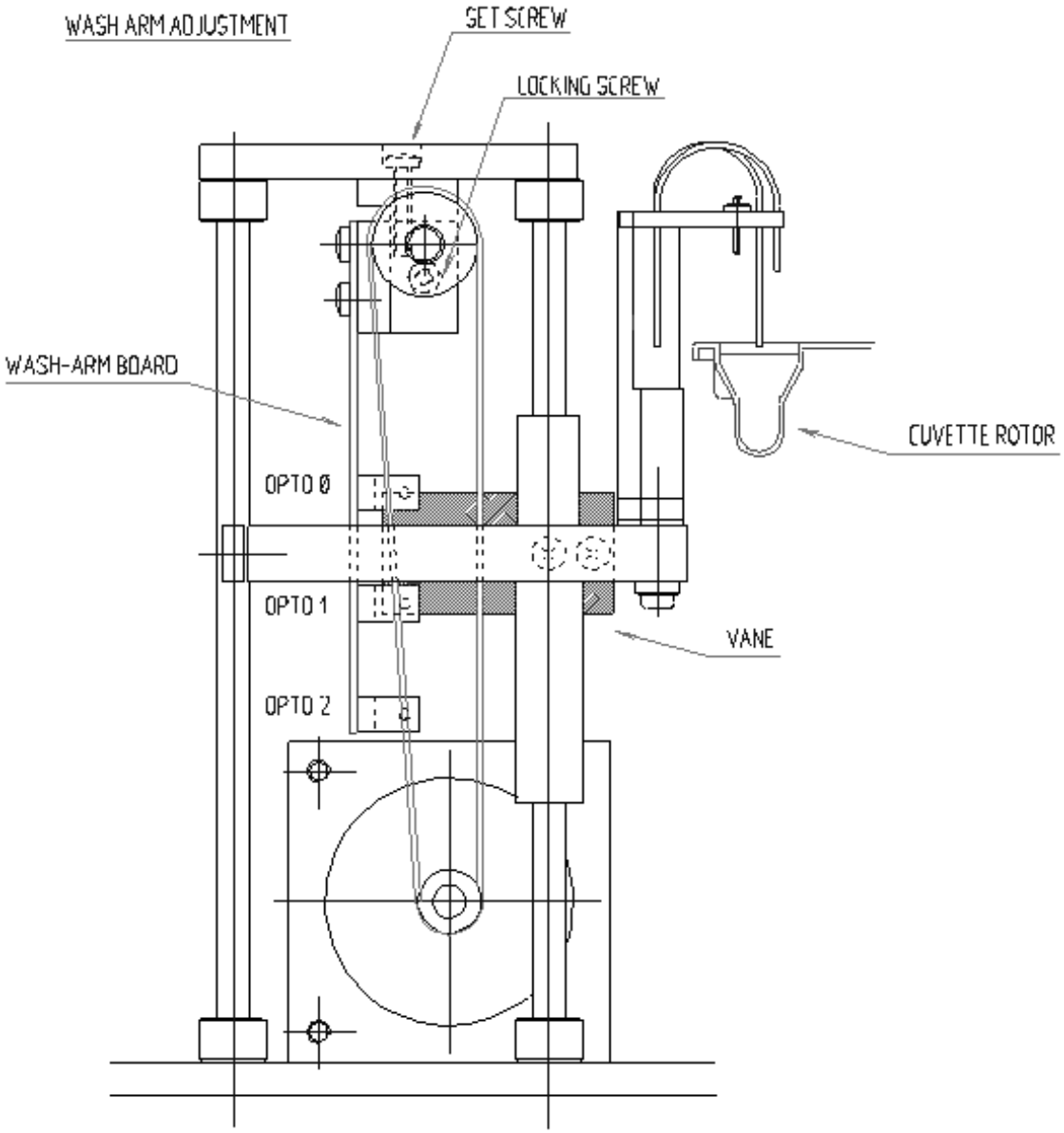


Figure 2.4 - Wash unit

The positions of the wash arm are detected by three opto-switches.
The opto-switches are mounted on a PCB (the so-called wash arm board).

The wash unit normally has three vertical positions. During normal operation two of them are accessed; up and down. Opto 1 is for detecting the up position and opto 2 is for the down position. Opto 0 is for detecting the high position of the wash arm (for changing of the cuvette rotor).

During the reset also the presence of the cuvette rotor is detected.
The wash arm will go downwards until it touches the bottom of the cuvette.
At this position opto 1 the vane is still positioned in opto 1. When no cuvette is present, the vane is not in opto 1, and error NO CUVETTE will be displayed.

Wash arm opto readings at the various wash arm positions:

	High	Up	Down	Detection of “no cuvette” during reset
Opto 0	1	0	1	1
Opto 1	1	0	0	1
Opto 2	1	1	0	0

The bellows pump consists of six separate bellows mounted together in one unit.
A stepper motor drives the bellows. The bellows pump has two defined positions; a zero position and a predefined full stroke volume position (500 µl is equal to 833 steps). The detection of both positions is done by opto-switches.

2.3.6 PIPETTOR

The pipettor is a precise diluter with motor driven valves and syringes.
The pipettor is controlled by one of the Motion Control Boards.
The liquid displacement is controlled by two stepper motor driven syringes:
the sample syringe (100 µl) and the reagent syringe (1000 µl).

Each syringe is connected to a special connection block that contains the valve unit.
The valves are driven by small DC-motors via a worm-wheel construction.

The syringe drive assembly is shown in figure 2.5.
The top and bottom position of the plunger is detected by two opto-switches.

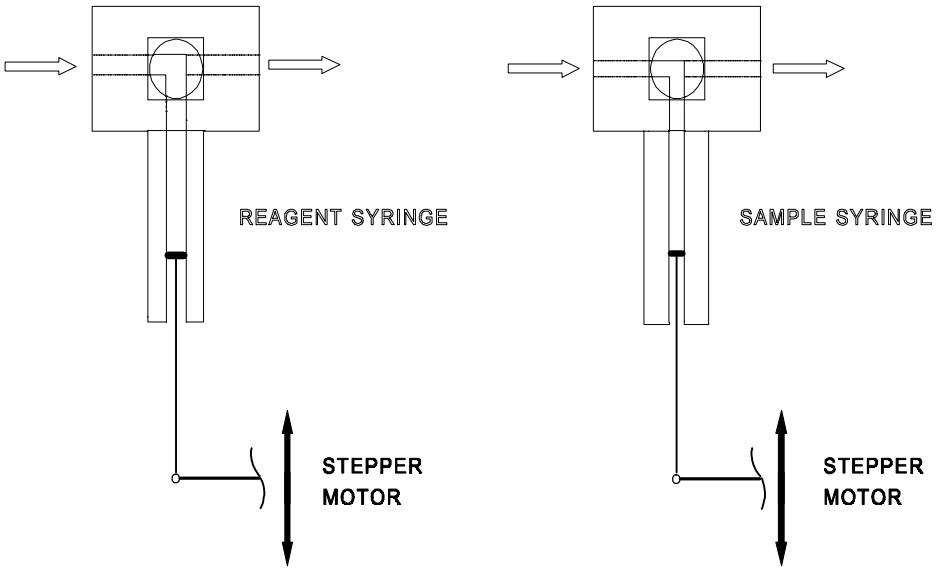


Figure 2.5 – Syringe drive assembly

The lower opto is also used for home initialisation, during the reset.
The four opto's are mounted together on a separate PCB.
The syringes are made of glass and the plungers are teflon-tipped.
The tubes that are connected to the valves are also made of teflon.

2.3.7 ISE ARM (Optional)

The ISE arm is integrated in the mixer assembly.
Figure 2.6 shows the complete assembly.
The communication with the external ISE measuring unit is done by a serial RS232 inter face. The serial interface connector is mounted at the left side of the instrument.

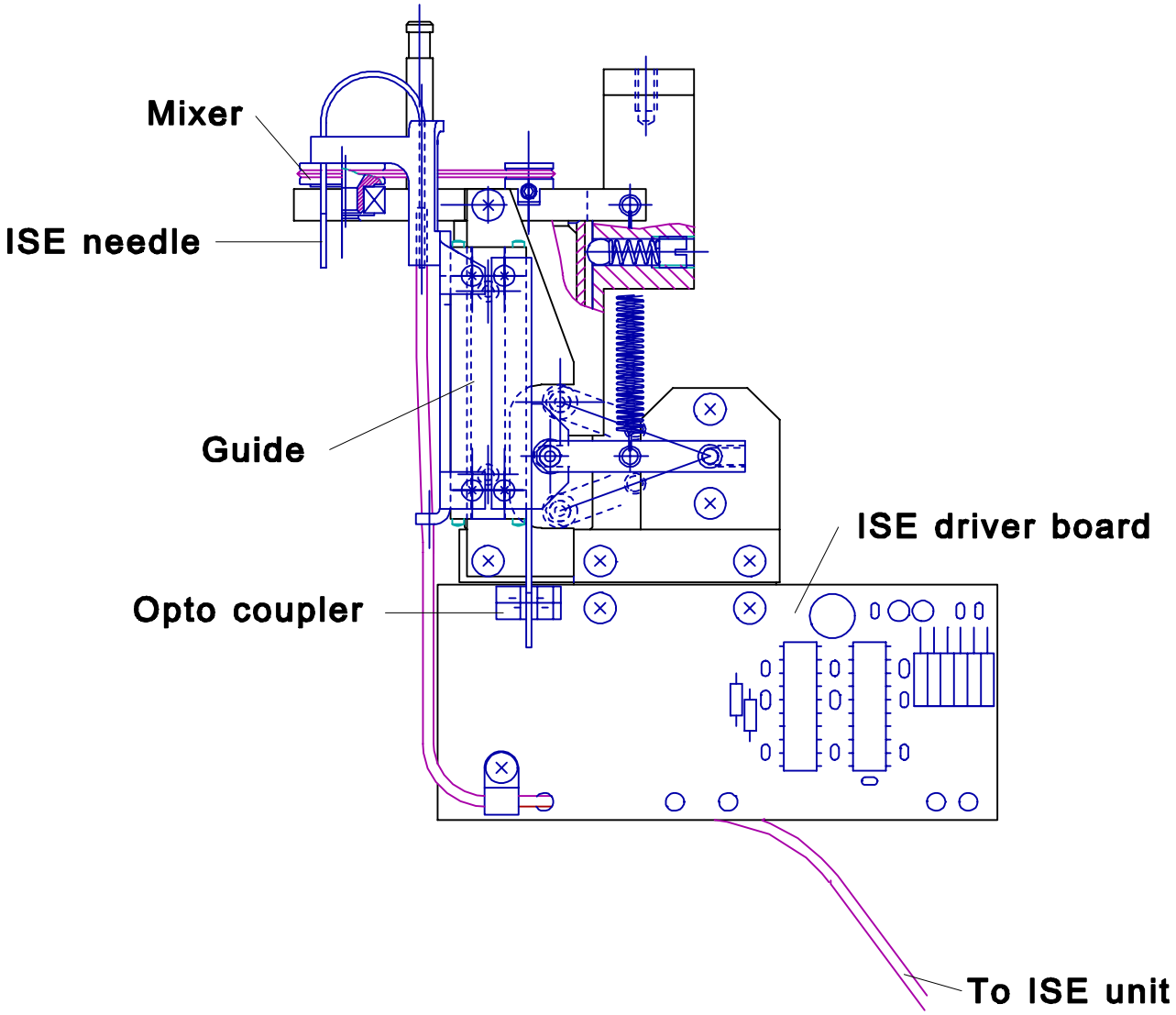


Figure 2.6 - ISE arm

An electro magnet that moves the needle into its aspirate position drives the ISE needle. An opto switch detects the lower position of the needle. The electronic driver circuits for magnet and mixer are located on the ISE driver board. The system board does the control of these functions.

2.3.8 MOTOR ENCODERS

Some of the stepper motors are equipped with an encoder disc on the shaft.
In conjunction with two opto-switches (A and B) they check the number of steps and the direction of the stepper motor. This way loss of steps can be detected.

These are the stepper motors that are equipped with an encoder disc:

- Sample Rotor
- Reagent Rotor
- Cuvette Rotor
- Sample Arm (horizontal movement)
- Reagent Arm (horizontal movement)

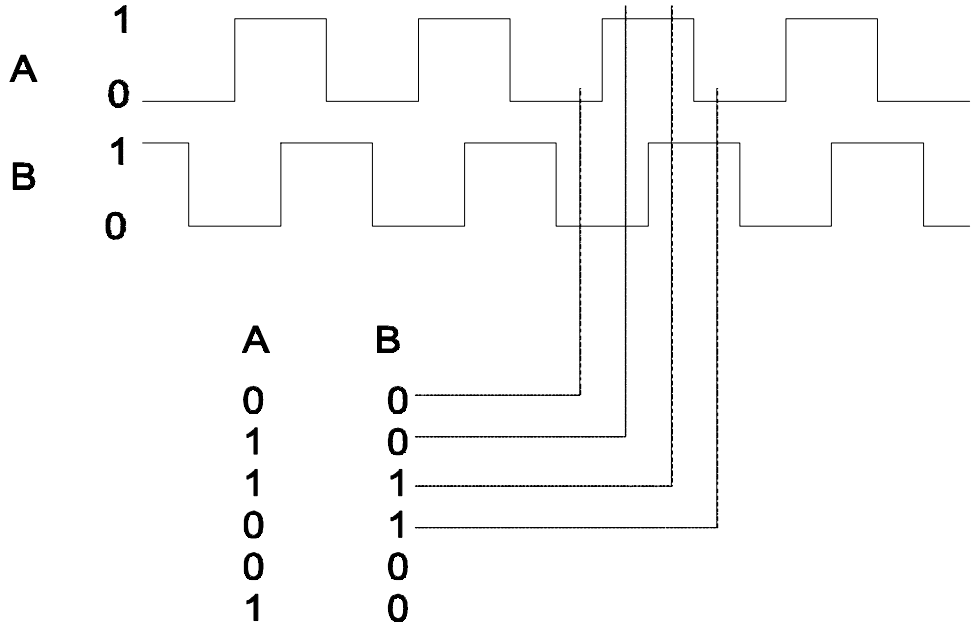


Figure 2.7 - Motor encoders

The phase relation between the two encoder signals should be around 90 degrees, otherwise the software cannot detect all transitions and loss of steps will be reported, even if no actual loss of steps has occurred.

2.4 DETECTION SYSTEMS

The instrument is equipped with the following detection systems:

- sample level detection
- reagent level detection
- water buffer level detection
- overflow detection for cuvette
- waste full detection

2.4.1 SAMPLE LEVEL DETECTION

The sample arm is equipped with a detector that will detect the liquid level of the sample and will given an error when not enough sample is present in the cup.

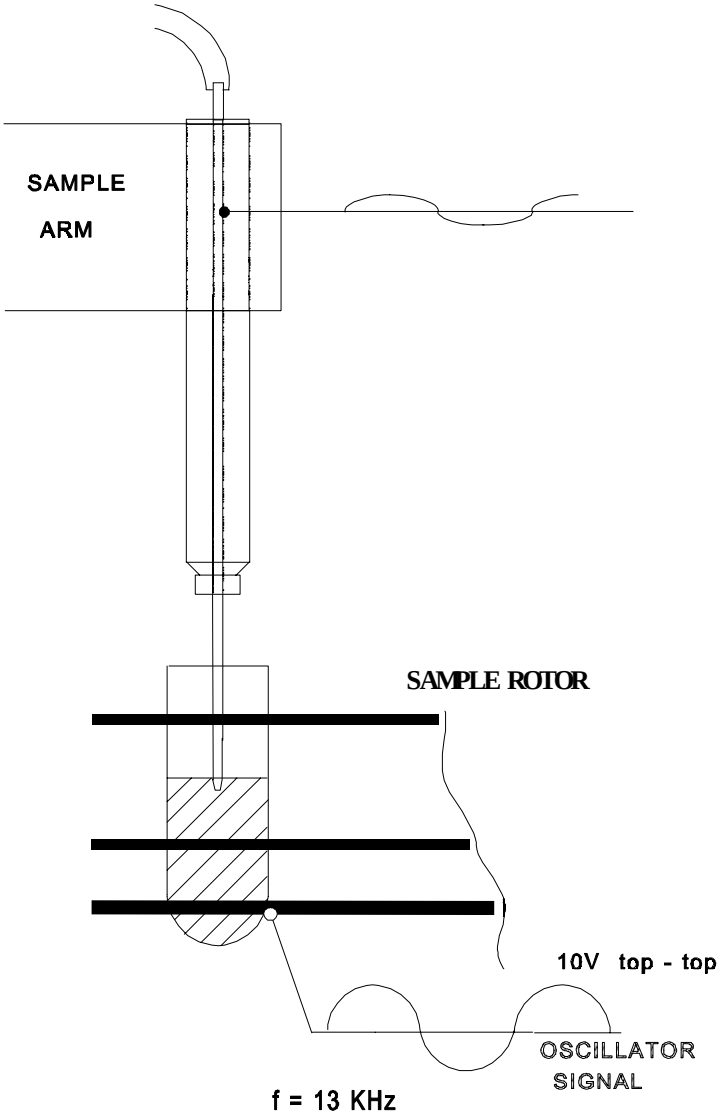


Figure 2.8 - Sample level detection

The principle of this detection is based on capacity.
An oscillator signal of 10V / 13 kHz is connected to the metal sample rotor, which is isolated from the rest of the frame. The sample cup and sample itself serve as dielectric so the signal can reach the sample needle.

When the sample needle touches the sample this is immediately detected by the PLL-circuit (Phase Locked Loop), after which the sample needle will go down a few more steps in order to be able to aspirate enough sample.

When the sample cup is empty, no capacity is detected.
Message INSUFFICIENT SAMPLE FOR XXX will appear in the results.

Note that the dead volume depends on the type of the sample rotor.

2.4.2 REAGENT LEVEL DETECTION

The principle of the reagent level detection is exactly the same as that of the sample level detection.

Note that when no reagent is detected, the error message NO REAGENT ON XXX is immediately displayed on the screen.

2.4.3 WATER BUFFER LEVEL DETECTION

The water cask is provided with a system to detect the water level and to switch the water pump on and off. Two float switches (based on reed relays) which are mounted in the water cask (see figure 2.9) detect the level.

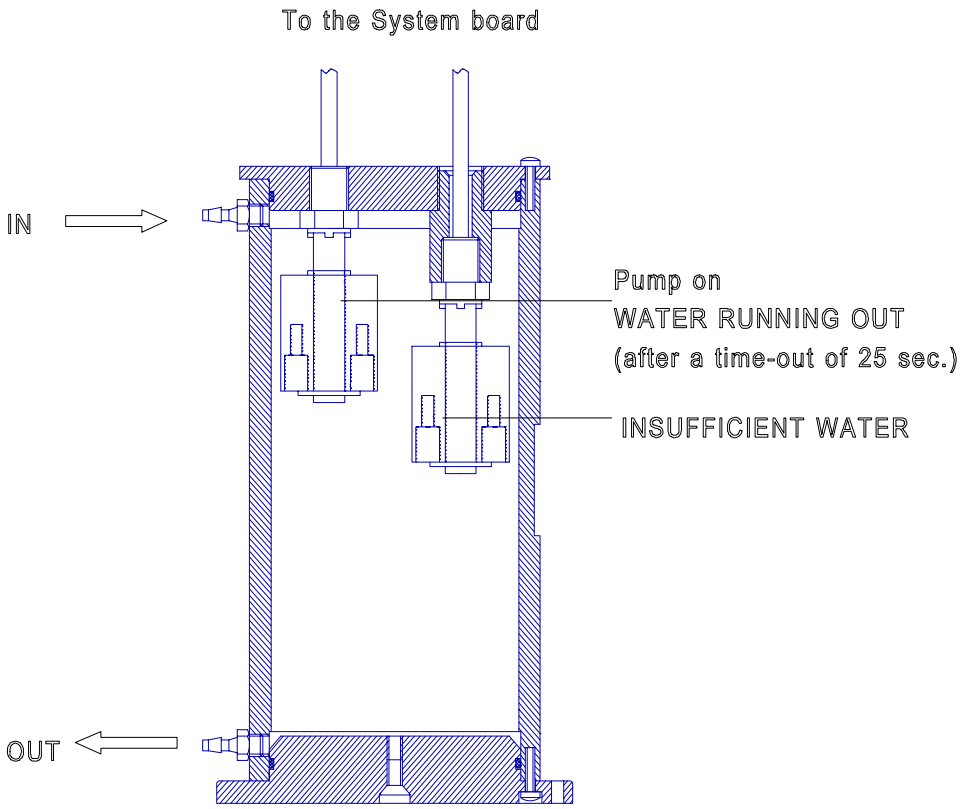


Figure 2.9 - Water level detection

The system board controls the water pump. When the upper float switch detects “no water” the water pump will be switched on for 25 seconds. When after this time the float switch is still detecting “no water” the error message WATER RUNNING OUT will be displayed on the screen and the pump will be switched on again for 25 seconds.

When the lower float switch detects “no water” the error INSUFFICIENT WATER will be displayed. When this message appears the instrument will not dispense sample or reagent any more, however it will finish all the measurements in the cuvette rotor.

2.4.4 OVERFLOW DETECTION FOR CUVETTE

The cuvette rotor is equipped with an overflow detection to detect if the liquid level in a cuvette becomes too high.

The principle of the detection is based on conductivity. The principle is shown in figure 2.10. The resistance between the liquid sensor and the needles is measured as soon as the wash arm is going down; If the liquid sensor touches the water in the low position of the wash arm the resistance is low and the system will report a WATER OVERFLOW MEASUREMENT DISC error.

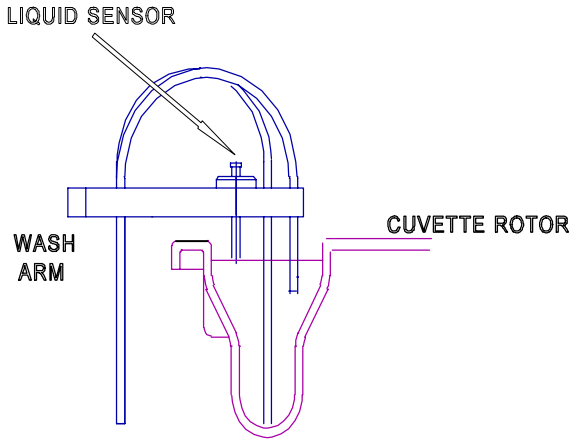


Figure 2.10 - Overflow detection

2.5 OPTICAL SYSTEM

Figure 2.11 shows the optical system of the analyser.

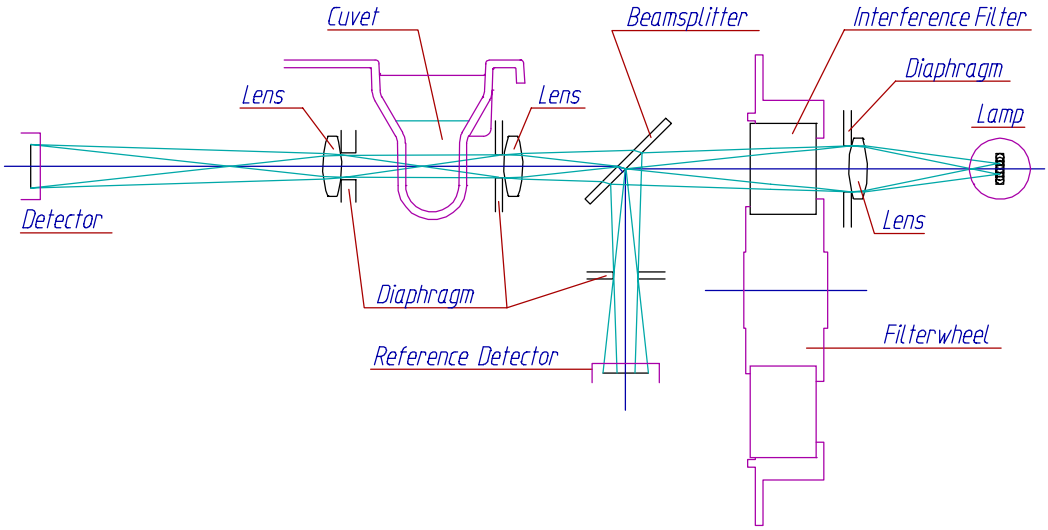


Figure 2.11 - Optical system

The light source consists of a long-life quartz iodine lamp (12V/20W, 2000 hour life-time), and the detector is made of a UV-enhanced silicon photocell.

Monochromatic light is achieved by using single IFL (InterFerence Line) filters. The filters are mounted in a stepper motor driven, 8-position filter wheel. Depending on the programmed wavelength, the microprocessor will automatically select the correct filter, and the filter wheel will move to the correct position.

The used IFL filters have an integrated coloured glass filter, depending on the wavelength of the IFL filter two types are used. For the low wavelength range a filter is used to reduce the effects from stray-light, by blocking light of higher wavelength.

For the high wavelength range a filter is used to level difference in energy at the high ends of the spectral range.

This will be necessary, because the spectral emission of the quartz iodine and spectral response of the detector are much higher in the visible and near infra-red range than in the near ultra-violet range.

The filament of the lamp is projected in the lens in front of the filterwheel. After the filterwheel a beam splitter is mounted which splits the light beam; 90% of the signal is going through the second lens and cuvette, and 10% of the signal is going into the direction of the reference detector.

The function of the reference detector is to detect and to compensate for the fluctuations of the lamp.

The optimal alignment and lamp intensity can be reached by adjusting the lamp.

2.6 FLUID AND VACUUM SYSTEM

Figure 2.12 shows an overview of the main parts of the fluid and vacuum system.

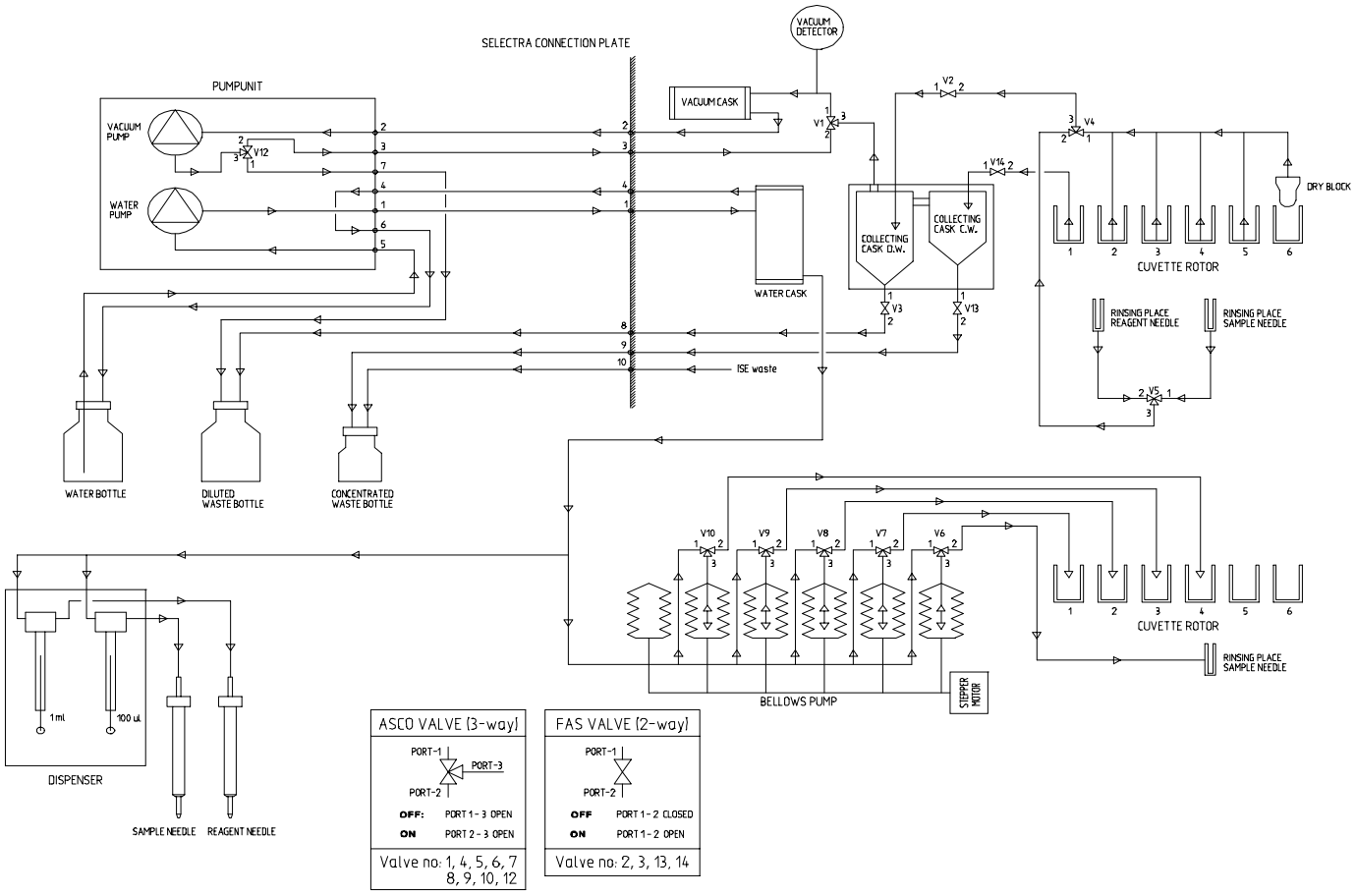


Figure 2.12 - Fluid and vacuum system

Optional the instrument is equipped with two separated waste circuits for diluted and concentrated waste. The concentrated waste consists of the waste of the first needle from the wash arm (the reaction mixture) and the waste from the optional ISE unit. The normal diluted waste is coming from the rest of the system like the other needles from the wash arm and the wash positions for reagent and sample needle.

The waste for both systems is collected into two separate waste containers.

2.6.1 FILLING OF THE CUVETTE ROTOR AND WASH POSITIONS

The filling of the cuvette rotor is done by means of a bellows pump that is driven by a stepper motor. The volume is 4 x 500 µl per rotation cycle. In total 4 cuvettes are washed (filled and emptied) at the same time. Also the sample needle is washed with 500 µl water at the wash position.

When the water pump is switched on, water will be pumped from the water bottle to the water cask. The water cask is equipped with a system for detecting the water level (see section 2.4.3). When the water level is too low, the water pump will be switched on, and when the level is high enough the pump will be switched off.

When the switch-off circuit is defective, the water will flow back into the water container via the overflow connection.

The filling of the cuvette rotor and sample wash position is performed as follows:

Valve V6 to V10 are not activated, the bellows goes downwards and is aspirating water. Then V6 to V10 are activated and the bellows goes upwards and is dispensing water in the cuvette rotor and sample wash position and the valves V6 to V10 are de-activated again.

The reagent syringe fills the reagent wash position. The reagent valve will move to the aspirate position and the syringe plunger will go downwards and the syringe will be filled with water. Then the valve will move to the dispense position and the plunger will go upwards and water will be dispensed into the reagent wash position.

2.6.2 EMPTYING THE CUVETTE ROTOR

In the ‘active’ state the vacuum pump is always running. When all valves are closed/de-activated this will cause a vacuum in the collecting cask. In order to empty the cuvettes valve V2 will open and the wash arm needle will aspirate the cuvette contents into the collecting cask.

Optionally a separate parallel concentrated waste circuit will aspirate the contents of the first cuvette into a concentrated waste collecting cask.

2.6.3 EMPTYING THE WASH POSITIONS

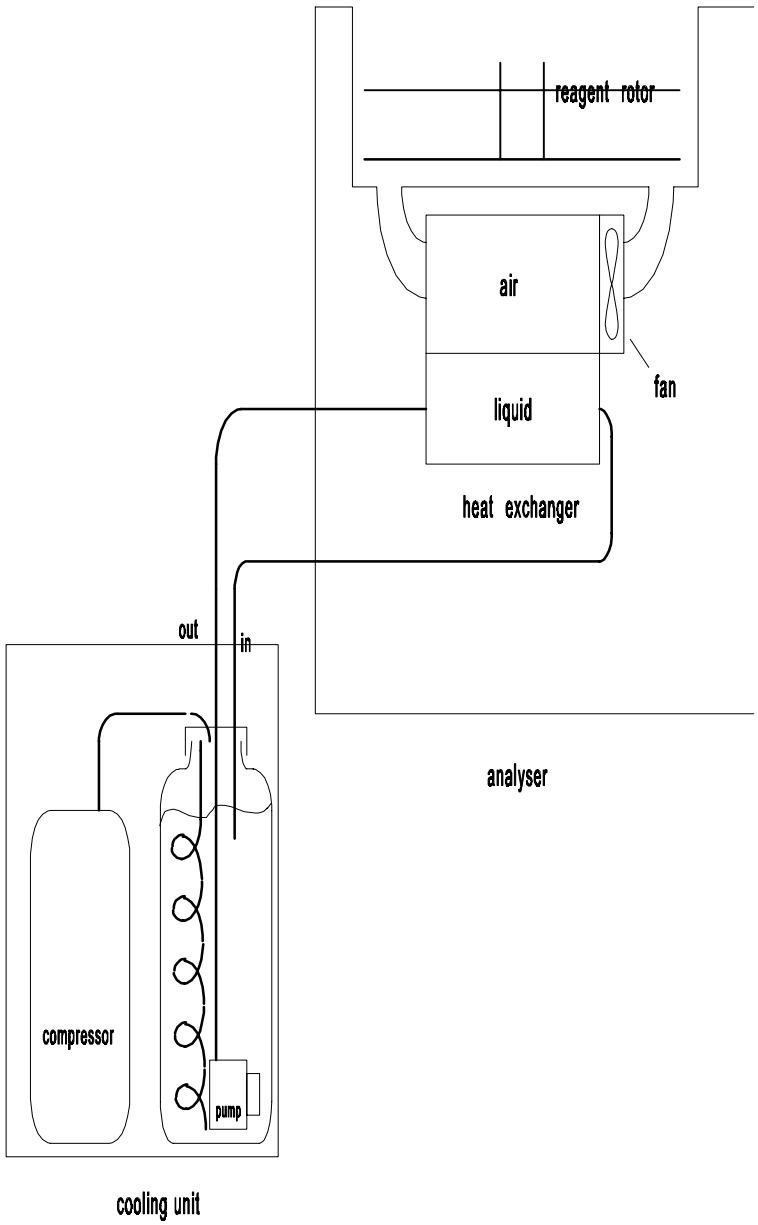
Valve V2 is closed and valve V4 and V5 are activated. When V2 will be opened the waste of the reagent wash position will be sucked into the collecting cask. When V5 is de-activated the waste of the sample wash position is sucked into the collecting cask, and the collecting cask will be emptied.

2.6.4 EMPTYING THE COLLECTING CASK

Valve V2 is closed and valve V3 is opened
Pressure will be put on the collecting cask by activating V1 and V12, and the collecting cask will be emptied and collected into the waste container.
Valve V1, V3 and V12 are de-activated again.

2.7 REAGENT COOLING

Reagent is cooled by means of an external cooling unit.
A cooling liquid is cooled down to a temperature set at the cooling unit.
This cooling liquid is then pumped through a heat exchanger in the analyser, from where cooled air is pumped through the reagent compartment.



The cooling liquid is based on Glycol. The temperature of the cooling unit is set at the cooling unit itself and is not checked by the analyser. Note that the temperature of the reagent is always higher than the set temperature.

The temperature setting of the cooling unit is protected so the user can not change the temperature. Below the procedure for changing this temperature is described.

When changing this temperature the situation in the lab should be taken into consideration.
For example a setting of 3 degrees might work well in an air-conditioned lab, but it could cause excessive condensation on tubes and heat exchanger in a warm lab with a high humidity.

Changing of the temperature setting

- push ⇑ and ⇓ at a time for 3 seconds (now in parameter mode)
- select by means of the ⇑ and ⇓ keys parameter P19 (protection)
- push set and keep it depressed and push ⇑ or ⇓ to set P19 to 0 (protection is now off)
- push ⇑ and ⇓ at a time for 3 seconds (return to normal operating mode)
- push set and keep it depressed and set the required temperature by means of ⇑ and ⇓
- push ⇑ and ⇓ at a time for 3 seconds (now in parameter mode)
- select by means of the ⇑ and ⇓ keys parameter P19 (protection)
- push set and keep it depressed and push ⇑ or ⇓ to set P19 to 1 (protection is now on)
- push ⇑ and ⇓ at a time for 3 seconds (return to normal operating mode)

Vital Scientific will take no responsibility for damaged cooling unit or analyser because of (too) low temperature setting or because of the use of an inadequate cooling liquid!

3 SYSTEM ORGANISATION

3.1 INTRODUCTION

A general system overview is shown in figure 3.1.

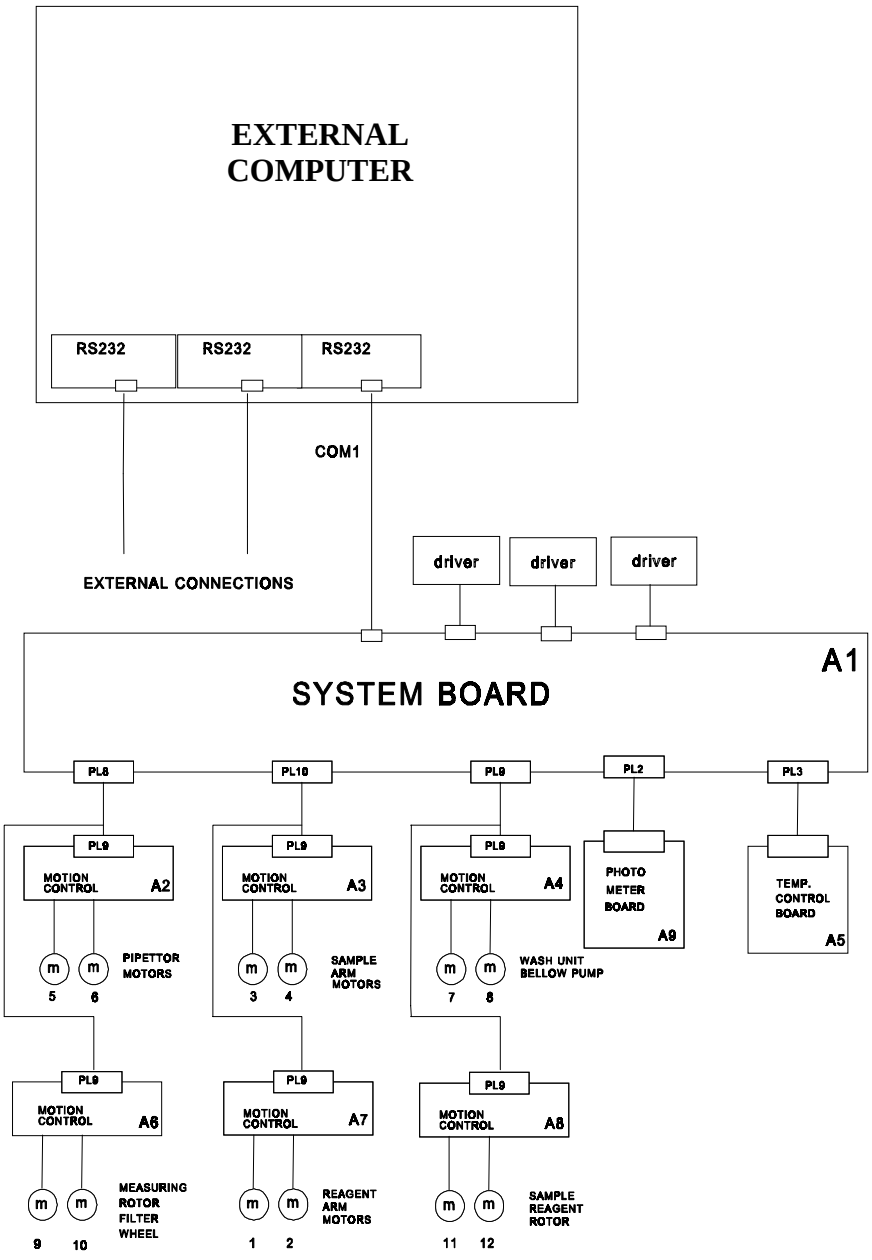


Figure 3.1 - System overview

The communication between the external computer and the System board is realized by means of a serial RS 232 line.

The System board is connected to six slave controllers, the so-called Motion Control Boards. The Motion Control Boards control all the mechanical movements.

Each board contains a (slave) processor and can handle two stepper motors with the corresponding in- and outputs.

The instrument is equipped with 12 stepper motors with the following subdivision:

Board	Motor 1	Motor 2
A2	Sample pipettor	Reagent pipettor
A3	Sample arm vertical	Sample arm horizontal
A4	Wash unit	Bellows pump
A6	Measuring rotor	Filter wheel
A7	Reagent arm vertical	Reagent arm horizontal
A8	Reagent rotor	Sample rotor

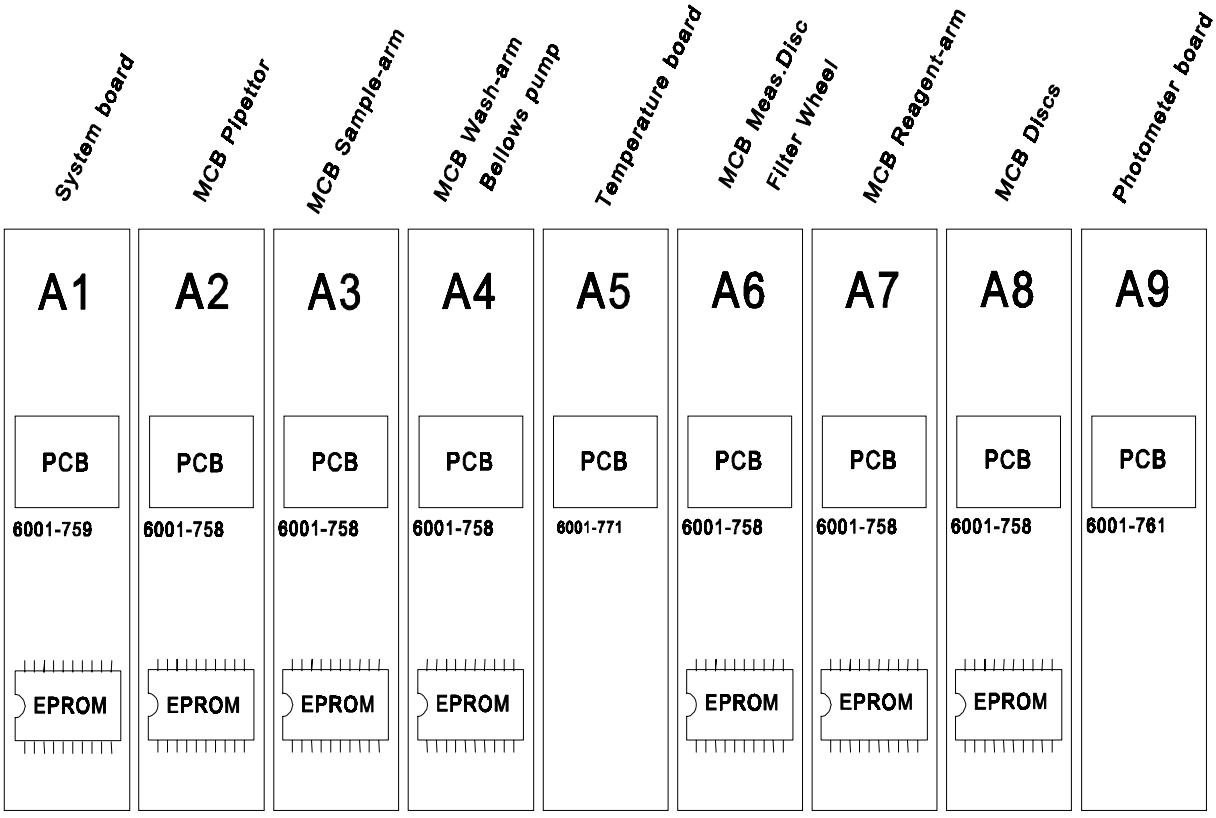


Figure 3.2 - PCB configuration

The System Board is also connected to the Photometer Board, where the actual photometric measurement is done. The measured values are transmitted to the System Board and the external computer.

3.2 SYSTEM BOARD

The overall functional control of the instrument is done by the System board and is exercised by a Z80 microprocessor.
The program for this board is stored in an EPROM.

The system board receives requests for tests from the external computer.
By means of serial communication ports it sends commands to the Motion Control Boards for all the movements and by means of digital outputs it drives, via driver boards, the valves and the pumps. Besides it switches on and off via digital outputs the various heating elements.

In combination with the photometer board the system board measures the extinction. The intermediate results are stored in the system data memory (RAM) that consists of a 32 Kbytes CMOS RAM.

The serial interface between the system board and the motion control boards is controlled via the three Serial Input Output (Z80-SIO) devices.

The Killer Input Output (Z80-KIO) is an integrated device which contains a CTC (Counter Timer Control), a PIO (Parallel Input Output) and a SIO with the following functions:

KIO-CTC: A/D conversion of the photometer signal and timing control.
KIO-PIO: controls the valves V1 to V14 and the signals for the vacuum switch, waste switch, pumps etcetera
KIO-SIO: serial connections with external computer and optional ISE-interface

The schematics and the wiring diagram of the system board is shown in section 8 of this manual.

The block diagram of the system board is shown in fig. 3.3.

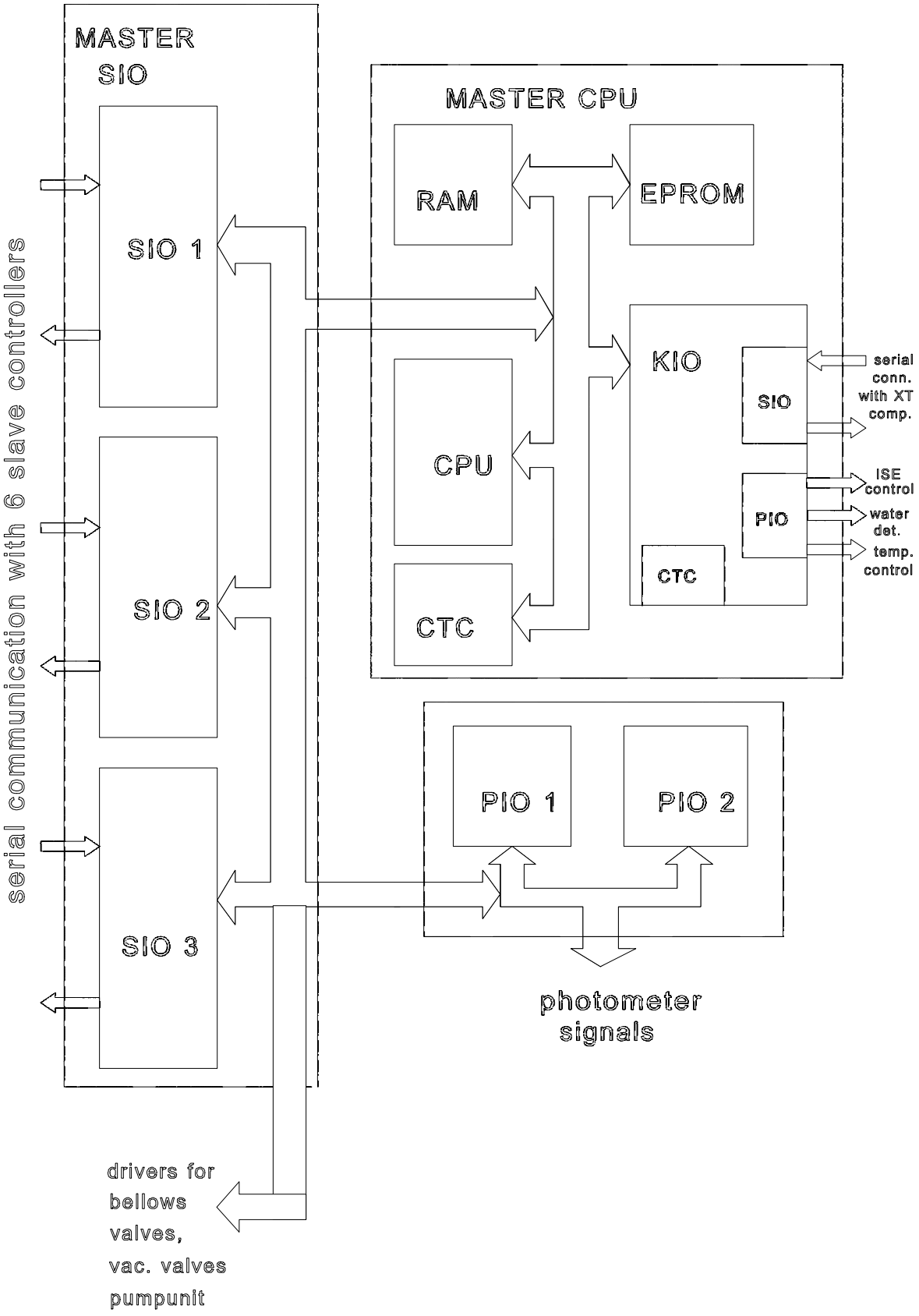


Figure 3.3 – Block diagram System Board

3.3 MOTION CONTROL BOARD

In figure 3.4 is the block diagram given of the motion control board.

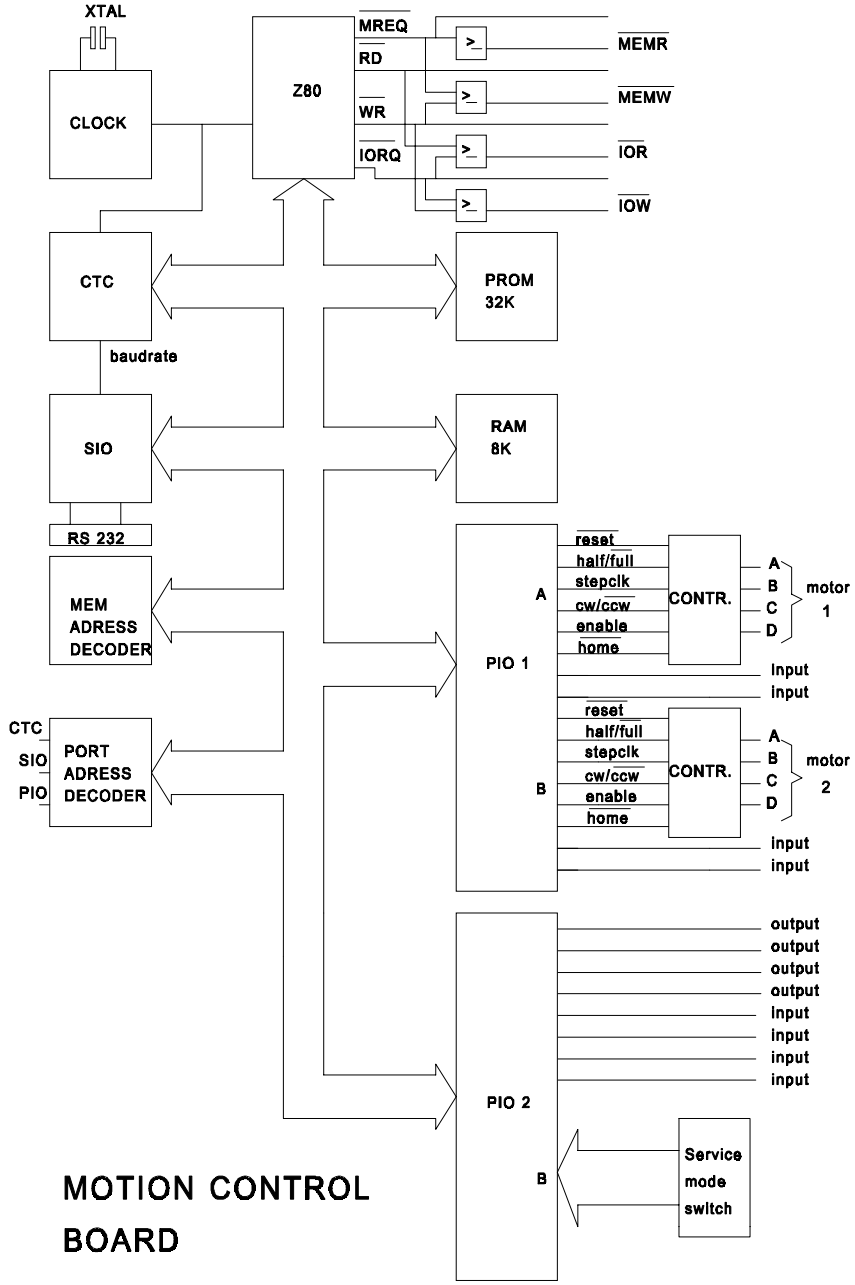


Figure 3.4 - Motion Control Board

Each motion control board controls two stepper motors. They receive the signals from reset opto's, decoder discs and needle switches to check the position.
Note that there are six identical motion control boards in the instrument with each a different function, therefore the EPROM version and the place in the instrument determines the function of the board.

3.3.1 STEPPER MOTOR CIRCUIT

Figure 3.5 shows the block diagram with the stepper motor circuit.

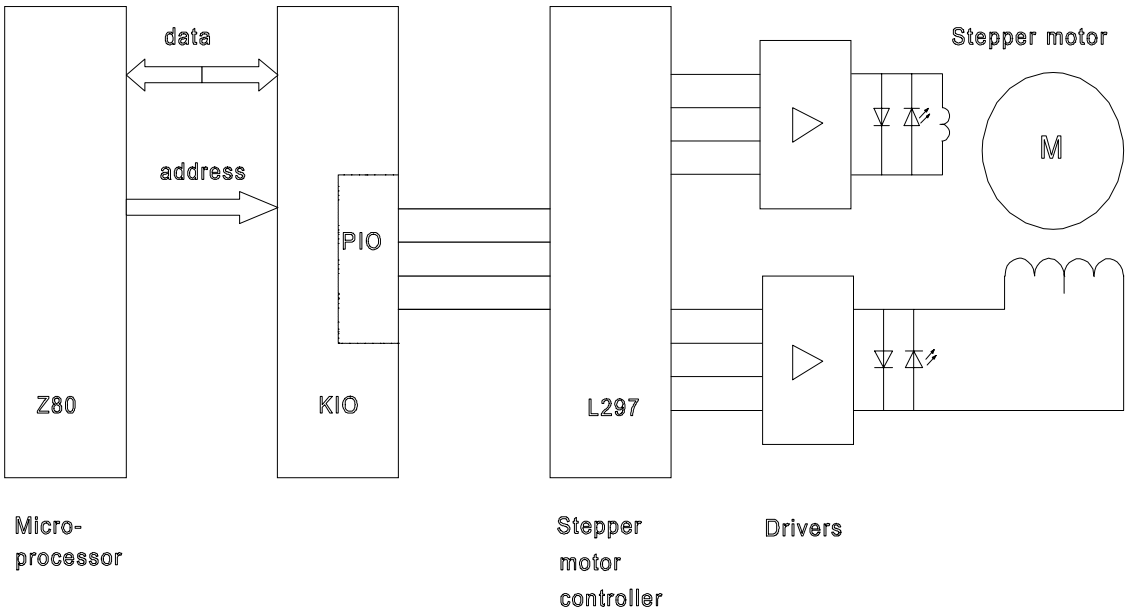


Figure 3.5 - Stepper motor circuit

The two stepper motors and their control circuits are identical.
The first two blocks are the microprocessor and the PIO that are part of the I/O array.
In principle there are only four lines necessary to control the stepper motor device (L297). This device has 8 output lines that control the stepper motor drivers (L6203).
On the output lines of the drivers fast ramping rectifiers can be found, to protect the drivers against high induction peaks.
There are also LED's to indicate if the output of the driver is activated.
When the stepper motors are normally running it seems that all LED's are on because the switching time is much faster than the human eye can detect.

3.4 TEMPERATURE CONTROL BOARD

The temperature control board has the following functions:

- temperature control of the cuvette rotor
- temperature control of the reagent needle
- lamp voltage control
- temperature driver for cuvette cover
- temperature driver for plate heat exchanger

The temperature control of the cuvette rotor is always working, unless the instrument is in the halted state or if a cuvette temperature error occurs.

The reagent needle is only heated when the instrument is in the active state.
On the service menu the needle temperature can be checked.

3.4.1 TEMPERATURE CONTROL CUVETTE ROTOR

The cuvette rotor is heated by two Peltier elements and the temperature is measured by a linear thermistor network. This network consists of two precision resistors, which are mounted on the board. The thermistor is mounted inside the cuvette rotor assembly.

The thermistor is connected to a 1V precision voltage supply and is wired to produce a voltage output that increases linearly with the temperature. The temperature control circuit can be divided into a number of separate circuits with the following functions:

- input amplifier
- differential amplifier
- dual followers
- Peltier element driving circuit

Figure 3.6 shows the block diagram of the temperature control.

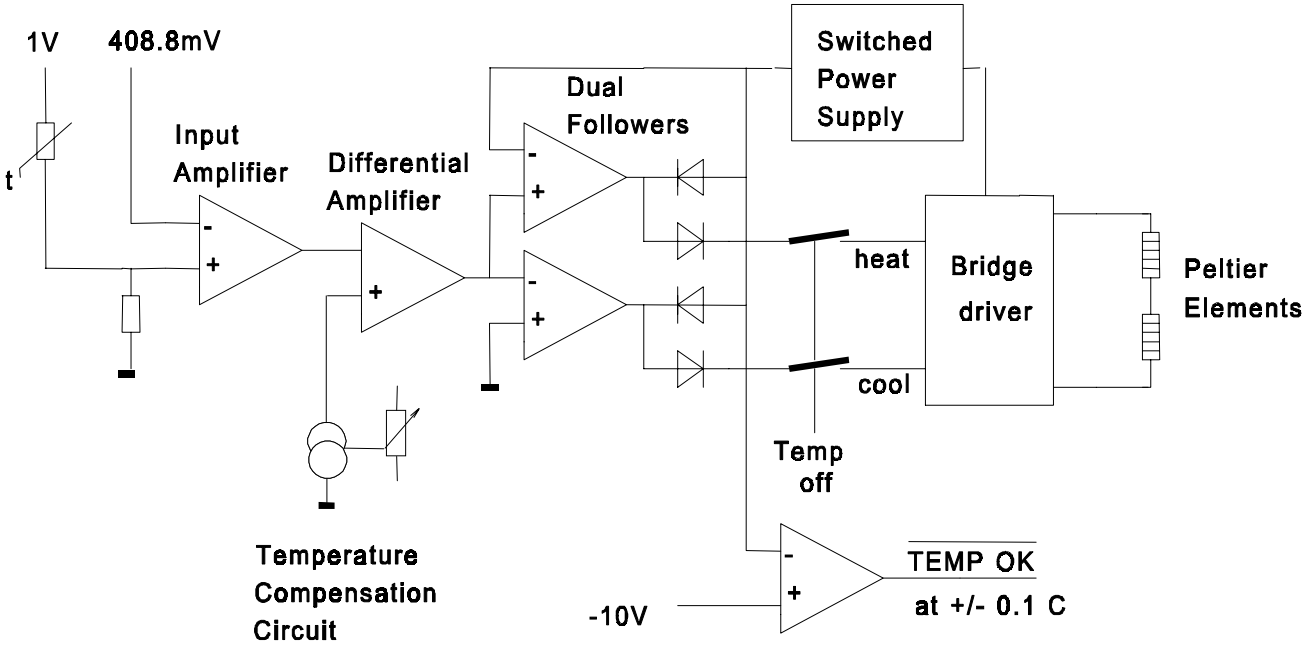


Figure 3.6 - Temperature control cuvette rotor

A complete schematic diagram is given in section 8 of this manual.

3.5 INPUT AMPLIFIER

The input amplifier circuit is built around IC10 which is a voltage OP-AMP (OP07). The purpose of this amplifier is to amplify the output of the thermistor (5.76 mV/°C) to an adequate level. The amplification is approximately 70x, therefore the output voltage of IC10 is approx. 400 mV/ °C. To extend the dynamic range of the amplifier, the inverting input of IC12 is derived from a reference voltage of 408.8mV.

3.5.1.1 DIFFERENTIAL AMPLIFIER

The second stage of the temperature control consists of a differential amplifier (IC9) and a compensation circuit board, which is mounted at the front of the analyser. The compensation board consist of an adjustable current source that is used as a remote sense temperature application.
IC4 will amplify the difference between the inputs.

3.5.1.2 DUAL FOLLOWERS

The output signal from the differential amplifier is connected to the inputs of the dual followers (IC8a and b).
Depending whether heating or cooling is required, the output of the differential amplifier is positive or negative.
The two dual driver outputs are connected together via diodes and connected to the switched power supply.
This signal that is connected to the power supply varies between 0V and -15V.
When the input signal is 0V the output voltage of the power supply is also 0V.
Depending which output of the followers is positive one half of the bridge driver is active. This means that the two outputs are controlling the current direction through the Peltier elements, and therefore selecting heating or cooling.

3.5.1.3 PELTIER DRIVING CIRCUIT

The Peltier elements driver circuit is built around the four FET transistors (T2, T3, T4 and T5). The two Peltiers are connected in series between point 3 and 4 of PL2.
If the measured temperature is lower then 37°C, the output voltage of IC9d is positive. The output voltage of IC8a will also be positive and will drive T3.
T7 will take away the gate voltage of T2. The current through the Peltier elements is going via T5, the Peltier elements and T2 to ground.
If the measured temperature is higher then 37°C, the output voltage of IC5b will be positive, and will drive T4. The current through the Peltier elements is then going via T3, the Peltier elements and T4 to ground.
The System board can monitor the temperature within ± 0.1 °C by means of the READY-signal (RDY). If the temperature is not reached within 5 minutes the microprocessor will switch-off the Peltier elements and will generate the CUVETTE TEMPERATURE ERROR.
Note that if the cuvette temperature error is acknowledged the error will not re-appear any more until the instrument is reset. The heating circuit is switched off!

3.5.2 TEMPERATURE CONTROL REAGENT NEEDLE

The temperature of the reagent needle is controlled by a heating element inside it. The temperature is measured by a NTC (Negative Temperature Coefficient) resistor.

The NTC (with a resistance of 22kΩ at 25°C) is connected to a 1V precision voltage supply and is wired to produce a voltage output that increases with the temperature. The temperature control circuit can be divided into a number of separate circuits with the following functions:

- input amplifier
- differential amplifier
- driving circuit

In figure 3.7 a schematic diagram is given for the temperature control.
A complete schematic diagram is given in section 8 of this manual.

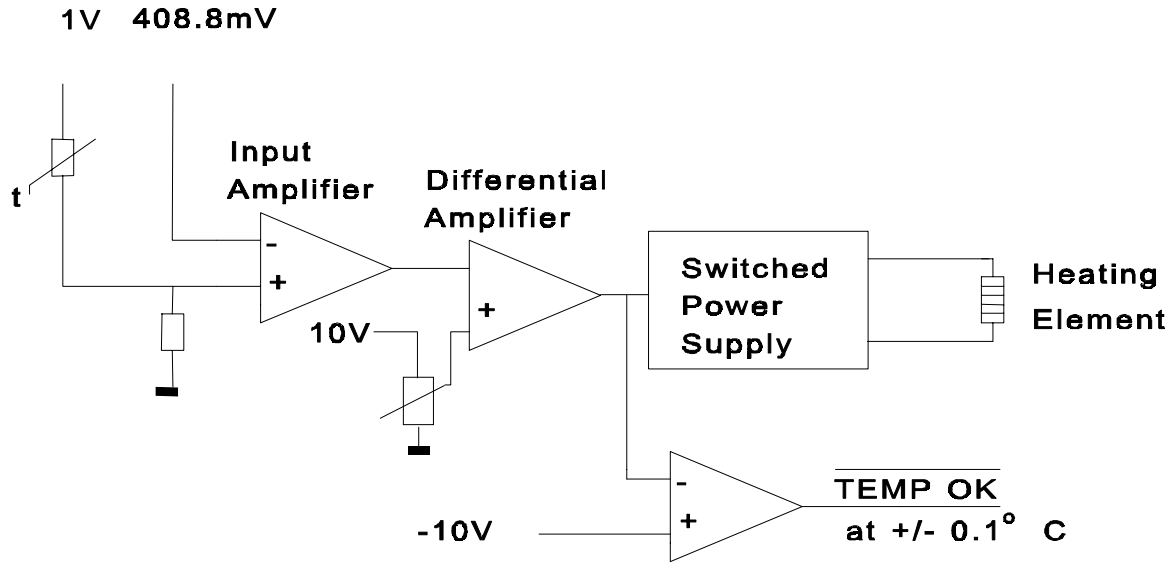


Figure 3.7 - Block diagram temperature control

3.5.2.1 INPUT AMPLIFIER

The input amplifier circuit is built around IC7 which is a voltage OP-AMP (OP07). The purpose of this amplifier is to amplify the difference at the inputs to an adequate level. The amplification is approximately 70x. The non-inverting input is derived from the NTC output (0.408 V at 37°C). To extend the dynamic range of the amplifier, the inverting input of IC7 is derived from a reference voltage of 408.8 mV.

3.5.2.2 DIFFERENTIAL AMPLIFIER

The second stage of the temperature control consists of differential amplifier IC6c.

The output of IC7 that corresponds to the actual temperature is present at the inverting input of IC6c, while the other input is connected to the reference voltage. This reference voltage can be adjusted and is derived from the 10 volts reference source. IC6c will amplify the difference between the inputs.

3.5.2.3 DRIVING CIRCUIT

The output signal from IC10a is going via a amplification circuit (IC6d) to the switched power supply circuit.

The System board can monitor if the temperature is within ± 0.1 °C by means of the READY-signal (RDY). If the temperature is not reached within 2.5 minutes the microprocessor will switch-off the heating element and will generate the REAGENT NEEDLE TEMPERATURE ERROR.

3.5.3 LAMP VOLTAGE DRIVER

The lamp stabilizer circuit is built around IC5, a voltage regulator. One of the lamp leads is always connected to the voltage (14 V). The other lead is connected to ground via FET transistor T1. When the power is applied, the gate of the FET is controlled via resistor R34 and diode D10. The lamp voltage is measured via a resistor network and compared against the reference voltage. The regulator controls the gate of the FET transistor in such a way that the measured lamp voltage is the same as the reference voltage. The lamp voltage can be adjusted with P1.
The lamp can be switched on and off by activating or deactivating opto-coupler OC3B. The lamp will be activated by the microprocessor on the System board.
The overcurrent through the FET transistor T1 is protected by means of transistor T6 and R6.

3.6 PHOTOMETER BOARD

On the Photometer Board is the photometer electrical circuit. In the figure below the block diagram of this board shown.

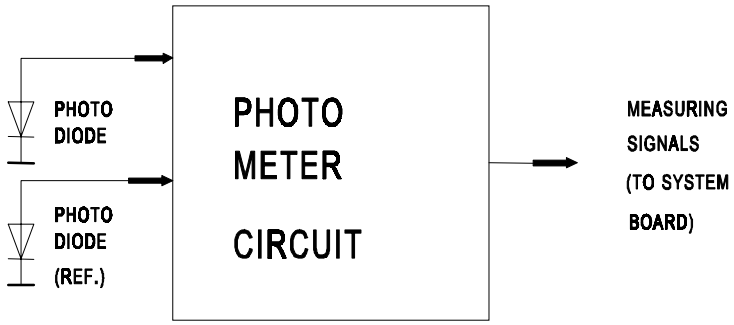


Figure 3.8 - Block diagram Photometer Board

The complete electrical diagram is given in section 8 of this manual.

3.6.1 PHOTOMETER CIRCUIT

The photometer circuit can be divided into the following two circuits:

- programmable input amplifier
- lin/log converter

On the photometer board are two identical circuits present; one for the actual measurement (PHOTOM), and one for the reference measurement (LAMP-REF). The function of the reference measurement is to compensate variations of the lamp. Because these circuits are identical only the operation of the actual input amplifier is explained.

The principle of the input amplifier is illustrated in figure 3.9.

The figure shows the actual amplifier (IC11) with one of the photo-diodes as input source and four switches controlled by the microprocessor (of the system board). By means of these four switches, sixteen different possibilities for the gain settings can be programmed.

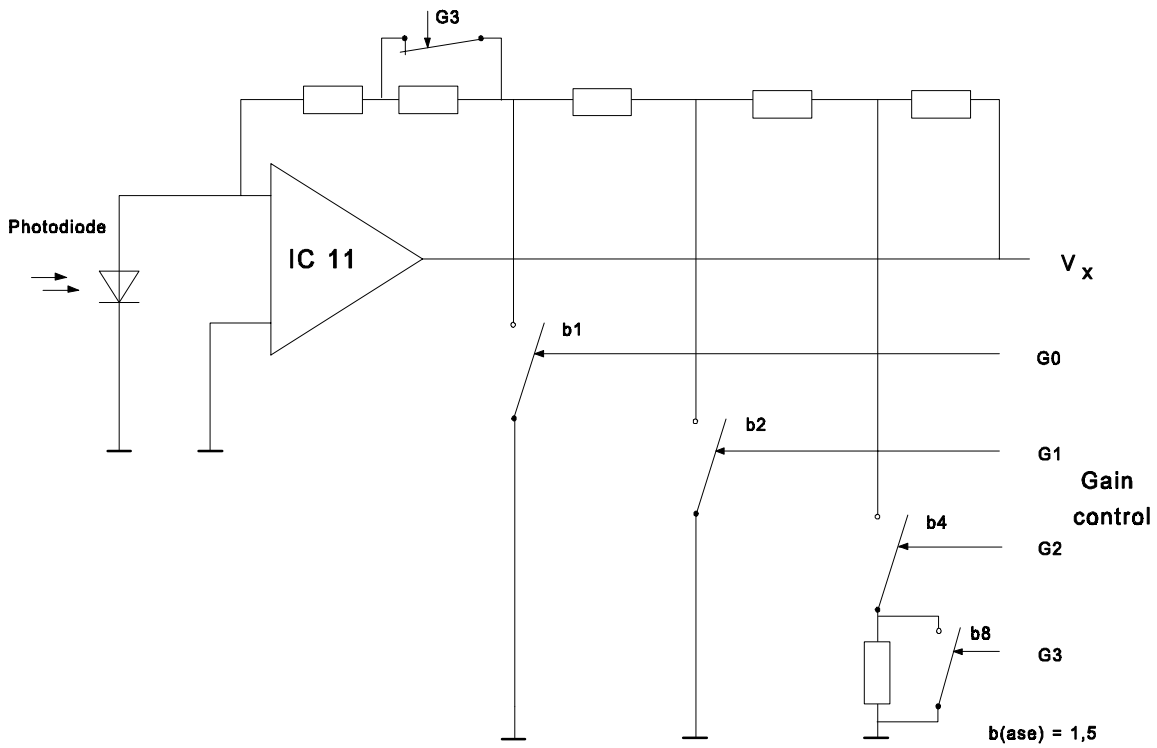


Figure 3.9 - Input amplifier principle diagram

Referring to the electrical diagram of the photometer board of section 8, the gain setting is performed by four signals, which are derived from the PIO of the System Board (P-G0 to P-G3). These signals directly control the FET switches of IC9.

Three of these FET switches perform, in combination with the relay contact from REL2, the actual amplification setting. By switching resistors R19, 20, 21, 22, 23 and 24 into the circuit, whilst the remaining resistor R26 is switched by means of the relay contact. The relay is switched by means of a FET switch IC8c and is controlled by the fourth signal (P-G3). The same fourth signal that controls the relay controls also FET switch IC9c and has a compensation function. This FET switch will switch resistor R18 into the circuit from amplification step 8 and onwards.
Note that the functions are reverse, from amplification step 0 to 7, P-G3 is active high, this means that REL2 is activated and FET switch IC14c also, and will short the resistor R24.

The gain factor (per step) equals the power of 1.5 and can be programmed in 16 steps from 1.5 to the power 0 up to 1.5 to the power 15, which will result in an amplification of 1 and 438 respectively.
Changing the amplification by 1 step, will cause an absorbance change of approximately 255 mAbs (log 1.5 x 10/6.88 = 0.255 Abs). According the law of Lambert Beer the absorbance is proportional with the lightpath. The log 1.5 value has to be recalculated because the amplification steps are based on a “standard” lightpath of 10mm. Therefore the absolute range is 15 x 0.255 = 3.82 Abs.

During the 'Blank' procedure a series of actions is started to produce the optimal gain for the programmable input amplifier. Because the gain of this amplifier is controlled in steps only, It needs no argument that it will be virtually impossible to control the amplifier to produce a certain voltage, corresponding to 100% transmission (0 Abs.) exactly.

Therefore, utilising a method of 'successive approximation', commonly used in A/D-converters, the gain is set in such a way that it drives the output of the amplifier to fit within a specific window. This window determines the maximum and minimum (negative) absorbance limits of the instrument. The lower limit is fixed at 145 mAbs, and the upper limit of the blanking window is 436 mAbs.

The theoretical range of the photometer is 0.436 + 3.82 = 4.256 Abs, but at this maximum amplification the noise and drift effects are also high.
Therefore a maximum amplification step of 12 is chosen.
At amplification step 12 the maximum absorbance value is 3.06 Abs.
The lowest level that still can be measured is therefore 3.496 Abs. (3.06 + 0.436).

The table below illustrates how the FET switches must be set to produce the required gain.

Note that if during the blank procedure, the instrument is not able to produce a gain, resulting that the absorbance value is within the 'blank' range an error will be displayed.

Right after blanking, the output voltage of the input amplifier will be between 5V and 7.94 V, unless overrange or under-range has occurred.

G3	G2	G1	G0	RELAY	AMPLIFICATION	ABSORBANCE
1	0	0	0	closed	1	0
1	0	0	1	closed	1.5	0.255
1	0	1	0	closed	2.25	0.51
1	0	1	1	closed	3.38	0.765
1	1	0	0	closed	5.06	1.02
1	1	0	1	closed	7.6	1.275
1	1	1	0	closed	11.4	1.53
1	1	1	1	closed	17.1	1.785
0	0	0	0	open	25.6	2.04
0	0	0	1	open	38.4	2.295
0	0	1	0	open	57.7	2.55
0	0	1	1	open	86.5	2.805
0	1	0	0	open	129.7	3.06
0	1	0	1	open	194.6	3.315
0	1	1	0	open	292	3.57
0	1	1	1	open	438	3.82

3.6.2 Lin / log converter

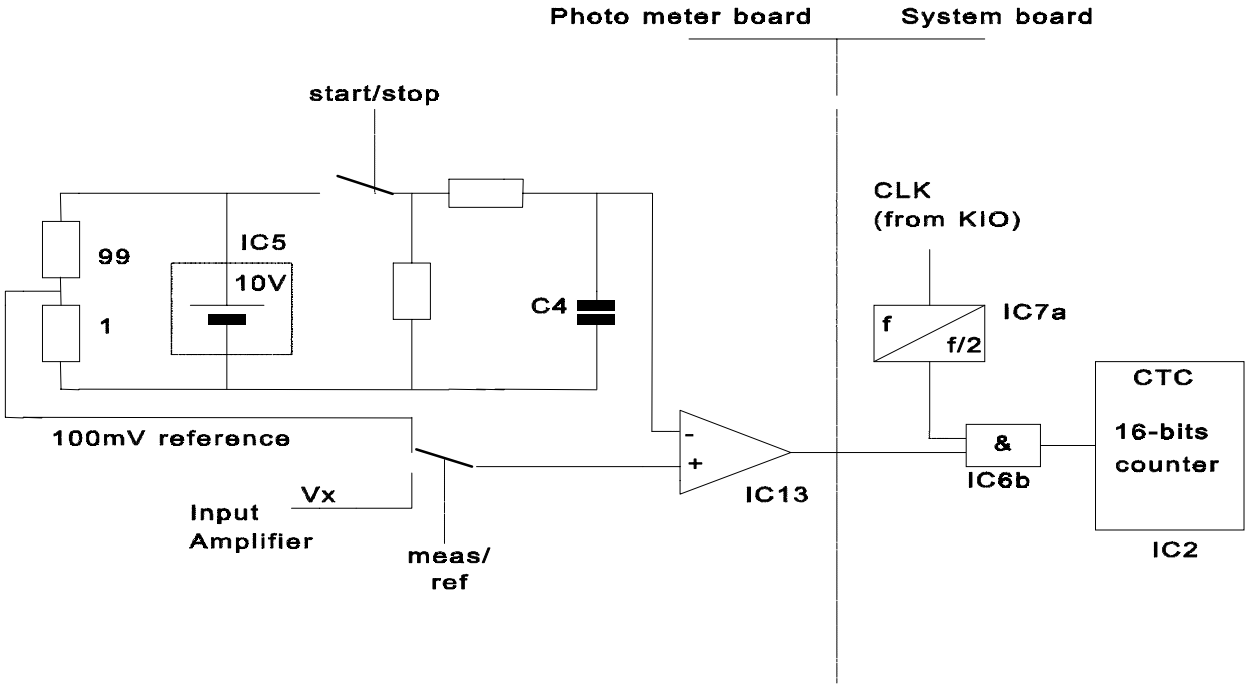


Figure 3.10 - Lin/Log converter

Conversion is achieved by utilizing the logarithmic discharge curve of capacitor C4. The voltage over this capacitor is compared to the linear voltage (Vx) and the time from the beginning of the discharge until both voltages are equal, correspond to the logarithm of the measured signal.

The discharge time is measured by starting a counter at the moment that the actual discharge is activated. The counter will be stopped the moment both voltages are equal (measuring and capacitor voltage).

The lin/log converter circuit consists of:

- Precision voltage source which supplies a very accurate 10V (IC5).
- Logarithmic curve generator (IC2 and C4)
- Comparator (IC4)
- FET switches (IC8)
- Digital parts that consist of a Counter Time Control (CTC), which is situated on the system board.

At the start of the logarithmic conversion, capacitor C4 will be charged to 10 Volts derived from IC5, by means of closing the FET switch (IC8d).
After a certain time (1msec.), the counters in the CTC will be enabled.
At the same moment, the selection of the input signal for conversion takes place (photocell signal or reference signal) and the FET switch IC8d is switched off, causing the logarithmic discharge curve to appear at the output of IC2.

This signal is compared to either a reference voltage via FET switch IC8a, or to the measuring voltage via FET switch IC8b.

The reference voltage for the comparison measurement is also obtained from the 10 Volts precision reference source, and has a nominal value of 100 mV.

During the time the logarithmic decreasing signal is higher than the measuring- or the reference-voltage. Depending which one has been selected for conversion , the counters in the CTC are fed with the high frequency clock (1.8432Mhz), derived from the main clock signal (KIO).

When the logarithmic decreasing signal is higher than the measuring signal as described above, the output of comparator IC13 is high. This signal is referred as ‘start stop signal’ (PH-STRT) and the time this signal is high is depending of the voltage of the measured signal. This signal together with the high frequency clock are connected to an AND port. The output of this AND port (IC6b) is connected to the CLK/Trigger input of the 16-bits counter of the CTC.

When the logarithmic signal becomes less than the measuring / reference signal, the output of comparator IC4 is dropped low and the high frequency clock will not pass the AND port anymore.

In case the measuring signal (which is in fact the relative transmission in this stage of the signal processing) is selected, the amount of clock pulses stored in the counters after conversion corresponds to the logarithm of this signal.

To compensate for temperature and component variations, measuring and reference signals are measured alternately.

As already mentioned before, the reference value is equal to 100 mVolts, which in turn corresponds to 20.000 counts (and 2.000 mAbs.) after conversion. When due to changes in the characteristics of the circuit the reference value is no longer equal to 20.000 counts, it needs no argument that the measuring value will be affected proportionally! Therefore, measuring values are compensated for variations in the log conversion circuit by means of the measured reference signal.

It will be obvious that this kind of compensation has its limits.
Therefore, a range of plus and minus 1000 counts has been established, and as long as the reference value is within the specified window of 19.000 to 21.000 counts, the circuit is assumed to function correctly and compensation will be carried out as described before.

When a reference value is measured which is outside the specified range, the instrument will give an error.

3.7 PLL BOARD

The liquid detection circuits of the sample needle and the reagent needle are located on the PLL board and are built around IC1 and IC2 for the sample level detection and IC3 and IC4 for the reagent level detection. The detailed diagrams are shown in section 8 of this manual.

An oscillator signal of 13 kHz (10V top-top) is made by the oscillator circuit built around opamp IC2 (IC4). This signal is connected to the mechanical assembly of the rotor.

This oscillator signal will be returned to this circuitry via the cup (bottle), needle, the FET transistor of the arm board (inside the arm) and will be recognized by the PLL (Phase Locked Loop) circuit IC1 (IC3). The output of IC1 (IC3) will become high and will stop the vertical motor via the PIO and KIO of the Motion Control Board A3 (A7) for the sample arm control.

The coupling between the metal rotor and the metal needle is capacitive, where the tube and the liquid act as di-electricum.

The sensitivity of the liquid detection can be adjusted by means of one of the two potentiometers mounted on top of the PLL board.

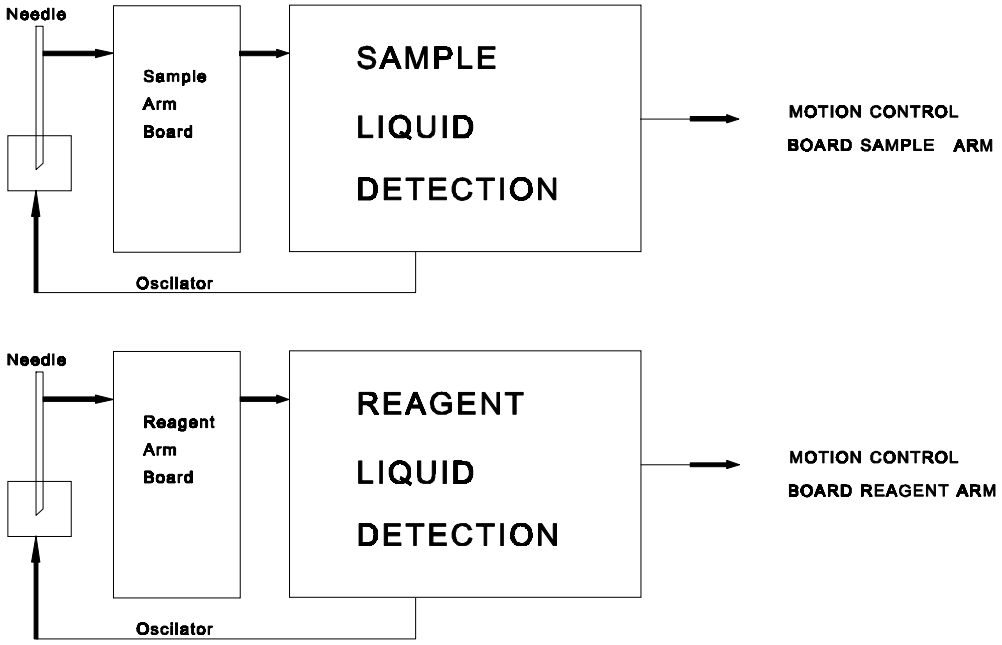


Figure 3.11 - Block diagram PLL Board

3.8 POWER SUPPLY

The DC power supply of the instrument is provided by a switched power supply.

The primary voltage is routed via the connection terminal to the switched power supply. Note that the power supply accepts input voltages from 95 to 264V with a frequency from 47 to 63 Hz.

The specifications of the switched power supply are as follows:

Output	Maximum current
5 V	5,5 A
12 V	2,5 A
14 V	10 A
30 V	10 A
GND	

These outputs supply the different voltages to the boards, fan's, etceteras
Refer to the DC wiring diagram of section 8, and the table below.

		5V	12V	14V	30V	GND
		Red	Green	Orange	Yellow	Black
Systemboard	6001-759	X		X	X	X
Mcb Dispenser Board	6001-758	X		X	X	X
Mcb Sample Arm Board	6001-758	X		X	X	X
Mcb Wash Arm Board	6001-758	X		X	X	X
Temperature Control Board	6001-771	X		X	X	X
Mcb Measuring Board	6001-758	X		X	X	X
Mcb Reagent Arm Board	6001-758	X		X	X	X
Mcb Discs Board	6001-758	X		X	X	X
Photometer Board	6001-761	X				X
Fans			X			X
Valve Boards	6001-870			X		X

For the power supply (3359-039) no exchangeable parts are available.

3.9 FUSES

The table below illustrates the fuses used in the instrument.

Description	Type	Location
Main Power Fuses	5 A	Below mains input
Cooling Unit Fuses	10 A Slow	Below mains input
Motion Control Board	3.15 A Slow	F 1-3
System Board	3.15 A Slow	F 1,2
Photometer Board	3.15 A Slow	F 1
Power Supply Output board	3.15 A Slow	F 1-5
Valve Board	3.15 A Slow	F 1
Temperature Board	3.15 A Slow	F 1-3
Cable Filter Board	3.15 A Slow	F 1

3.10 SYSTEM INITIALISATION

3.10.1.1 PIO initialisation

The microprocessor will first initialise the PIO's and set the lines that are designated as inputs and outputs.

3.10.1.2 RAM test

"1"-bits and "0"-bits are shifted through the memory to check the correct working.

3.10.1.3 ROM test

During this test the contents of the program memory (EPROM) is tested by means of a checksum.

3.10.1.4 CTC initialisation

At this time the counter registers are cleared and the interrupt frequency is set.

3.10.1.5 SIO initialisation

At this time the six serial interfaces to the motion control boards are initialized.
Then the initialisation of separate motion control boards is started.

3.11 SLAVES (MOTION CONTROL BOARD) INITIALISATION

The sequence of initialization of the six motion control boards is the same for all boards, except for the pipettor motion control board (A2); this board will perform besides the below mentioned initializations a ROM test.

1. KIO initialisation
2. CTC initialisation
3. PIO initialisation
4. ROM test (only for board A2)
5. RAM test
6. SIO initialisation

After this initialization the hardware-reset procedure is started and all functions are checked. The sequence of the reset procedure is fixed and is as follows:

1. wash arm, reagent and sample arm initially up
2. reset sample arm
3. reset reagent arm
4. reset measuring rotor
5. reset diluter
6. reset filterwheel
7. reset sample and reagent rotor
8. reset bellows pump
9. reset wash arm
10. move arms to wash position
11. fill bellows pump

When one the functions mentioned above is found not O.K. (reset position not found or otherwise), the reset procedure will stop at that step.
An error message will be displayed on the screen for the failing step and possibly also for the remaining, not performed steps.

4 INSTALLATION AND MAINTENANCE

4.1 INTRODUCTION

This section contains information for unpacking the instrument and the procedure for installation.

Please note that a qualified technician must do the installation and initial checkout of the instrument.

Important remarks for installation:

- Install the analyser in such a way that it is not exposed to (high intensity) direct sunlight and vibration (i.e. centrifuges).
- Avoid extreme high or low temperature and humidity
  (Ambient temperature 15 to 32 °C, maximum altitude of 3000 meter and maximum relative humidity 80% at 32°C non-condensing).
- Note that dust, corrosive vapour, dirt, etc. may affect the performance of the instrument.
- The line voltage, preferably a reliable connection should be selected. Additional connections of instruments with high surge-on (peak) currents to the same line should be avoided. Also make sure that the instrument is well grounded.
- Do not remove from or connect interface cables to the system when the power is on.

Cooling unit:

The separate cooling unit accepts a line voltage of 115 or 230V. Please note that the line voltage of the cooling unit is fixed and cannot be changed, the line voltage is mentioned at the type plate of the unit.

The power consumption of the cooling unit is 350 VA (max).

The power cords supplied with the instrument can either be the 220V (non-polarised), or the 110V type, depending on the type you have ordered.

Two fuses of 10 A slow must be placed.

4.2 UNPACKING AND INSTALLATION

Unpacking and installing the analyser.

The instrument is shipped in two boxes that contain:

- The analyser itself, pump unit, accessories
- Cooling unit

The boxes should be carefully inspected for damage.
If there is any major damage, or when parts are missing, this should be reported by means of filling out the Installation report.

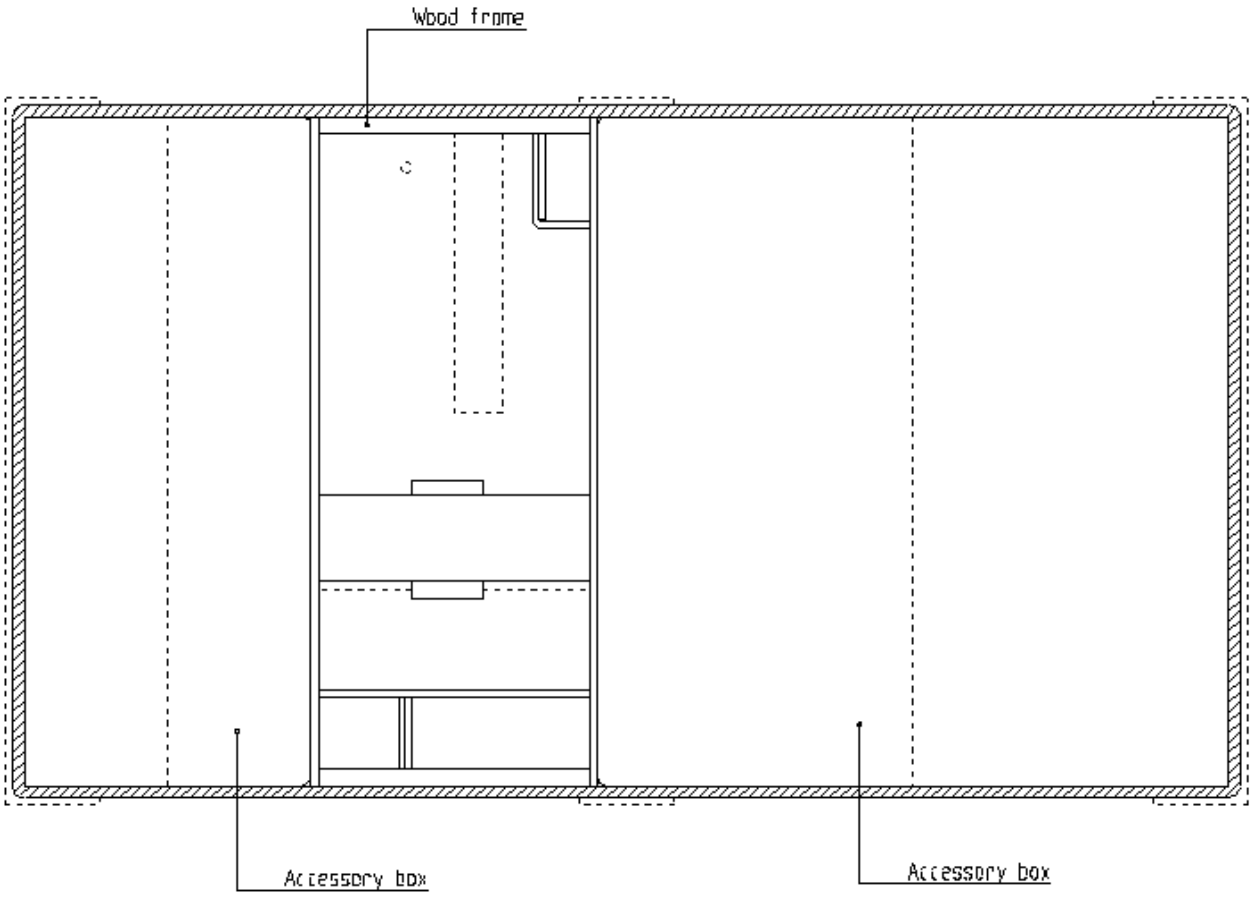
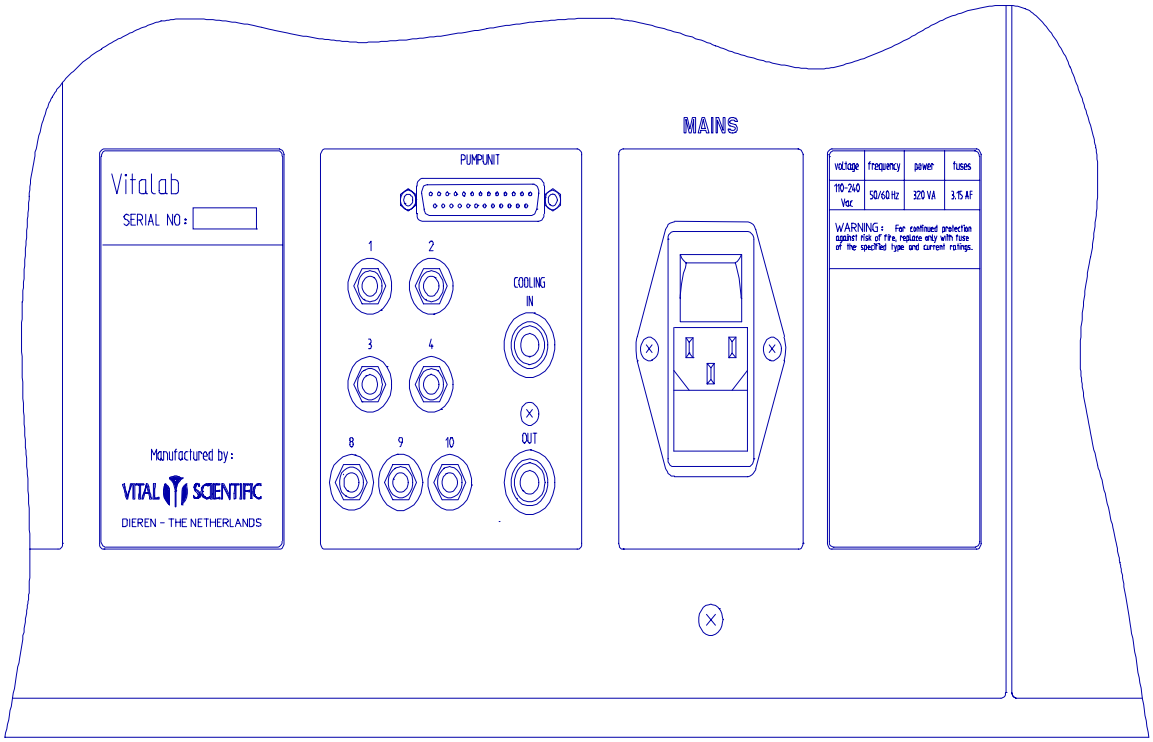


Figure 4.1 – Shipping box top view

The following procedure describes the recommended method for unpacking and installing the instrument:

1) Place the pallet with the instrument on the floor and open the top side of the box

2) A wooden frame is visible that protects the arms together with 2 accessory boxes
3) Unscrew the frame from the wooden box and remove it.
Carefully remove the 2 accessory boxes
4) Remove the cardboard packing material, unscrew the big cardboard box from the pallet and lift it over the instrument.
Take the remaining accessory box from the pallet.



5) Unscrew the instrument from the pallet (4 bolts) and place it in its operating position

Figure 4.2 – Rear panel

6) Remove the accessories packing and the packing of the cooling unit.
7) Remove the small packing foam between cuvette cover and large foam piece. Remove the large piece of foam under the arms. Remove the tubes around the arm shafts
8) Connect the cable from the pump unit to the connector marked PUMPUNIT at the rear of the instrument (see figure 4.2).

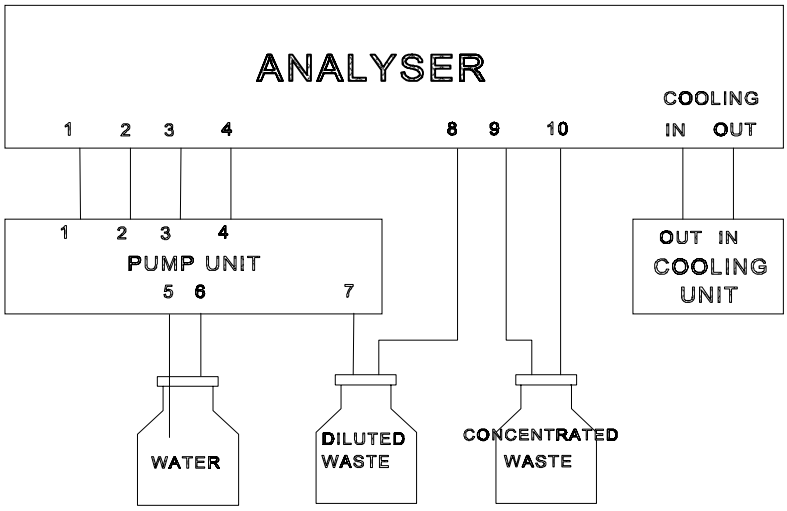
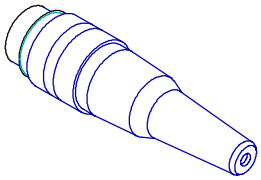


Figure 4.3 - Tubing diagram

9) Connect all tubing according to figure 4.3
10) Connect the waste detector plug of the diluted waste container to the connector marked “waste”.
11) Fill the water container with system liquid and bidest. (25 ml on a full water container)
12) Connect tubing between the cooling unit and analyser as shown in figure 4.3.
13) Place the Cooling unit at the final operating position.
14) Remove the filling lid from the cooling unit and fill the cooling unit with 2 litres of the cooling liquid. Add demineralised or distilled water until the liquid level almost reaches the top of the container. Close the lid again. The filling lid has an air tap that should be open so that it is possible for the liquid to expand because of temperature differences without building a pressure or vacuum.
15) Take care that you do not switch on the cooling unit without liquid because the pump will be damaged almost immediately !!!
    - Switch ON the cooling unit by means of the two switches in front of the unit marked “cooling” and “pump”.
    - See chapter 2.7 for changing temperature setting of the cooling unit
16) Place a cuvette rotor into the measurement rotor. Make sure not to touch the sides of the cuvettes.
17) Plug the power cord in the instrument and the other end into a grounded power outlet, and turn power on.

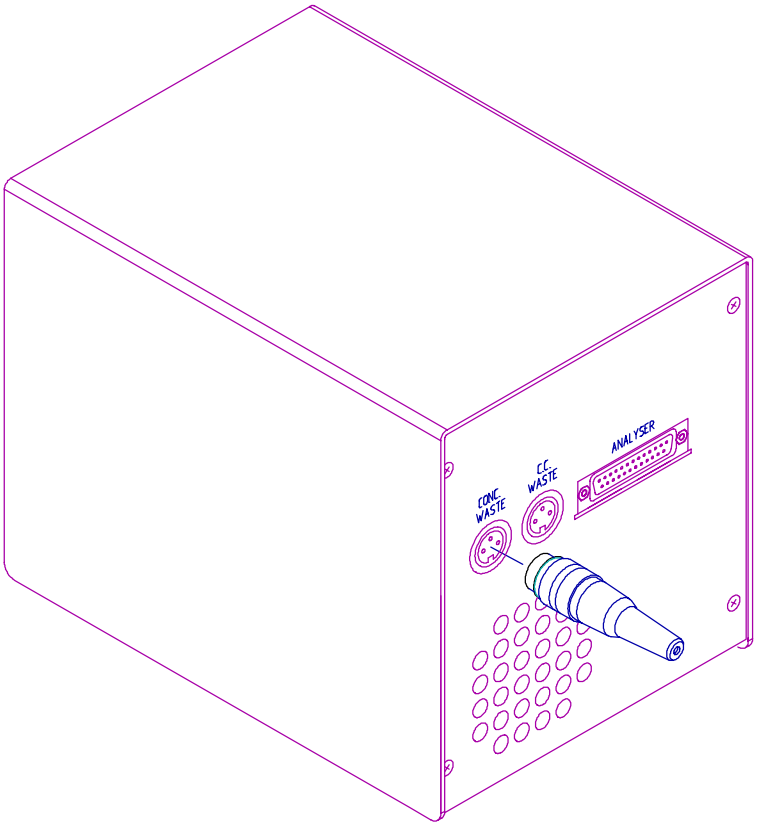
4.3 SUPPRESSION OF CONCENTRATED WASTE ALARM

Standard the instruments are delivered with the Concentrated Waste option NOT installed.
In this case the alarm indicating that the Concentrated Waste container is full has to be suppressed.
This is done by installing a special connector (part number 3351-028).



Part number 3351-028

The connector has to be placed in the slot of the pump unit where the fluid level detector for the Concentrated Waste container is connected:



4.4 SOFTWARE INSTALLATION

4.4.1 Ramdrive installation

The software needs a ramdrive. This must be drive E: size 1024kB.
If your PC doesn't have such a ramdrive, it has to be installed.

The ramdrive will always be installed after the local drives used in your PC.

There are three possibilities:

If your PC has only a drive C:, add the next two lines to the *config.sys* file in the C: directory:

devicehigh=c:\windows\ramdrive.sys 4 /e
devicehigh=c:\windows\ramdrive.sys 1024 /e

This creates TWO ramdrives called D: and E: size 4kB and 1024kB.
Ramdrive D: is a dummy drive, but is needed to be able to install a ramdrive on E:

If your PC has already drives C: and D: (harddisk and/or CDROM), add the next line to the *config.sys* file in the C: directory:

devicehigh=c:\windows\ramdrive.sys 1024 /e

This creates a ramdrive called E: with size 1024kB.

If your PC has already drives C: D: and E: (harddisk and/or CDROM), move the drive on E: to another location (F: through Z:) and proceed with the steps mentioned above.

4.4.2 DOS-memory maximisation

After the program is started, the program uses the memory left for the test results. This memory should be as large as possible. You can check the total free memory with the "mem" command in a DOS-box. It should be as close to 600k as possible.

To get as much memory for the DOS application as possible, check if the extended memory drivers are installed. The *config.sys* file should contain the next three lines:

device=c:\windows\himem.sys
device=c:\windows\emm386.exe ram
dos=high,umb

Depending on the Windows version, the second line should be omitted.

Try this and check if this gives more memory.

Always reboot your PC when you have changed the *config.sys* file!

For further information check your DOS manual.

4.5 PREVENTIVE MAINTENANCE

The analyser is designed to operate with a minimum of maintenance.

Repair equipment is kept to a minimum and common tools are used in most cases.

A list of special tools and other support equipment can be found in the price list.

To assure a high MTBF (Mean Time Between Failure) and an optimal operation a program of scheduled preventive maintenance is required. The schedule is detailed in the following paragraphs.

Note that the maintenance that can and should be performed by the operator is detailed in the Instruction Manual.

4.5.1 SCHEDULED MAINTENANCE

The maintenance described in this paragraph must be performed every 6 months.

Required equipment:
- 2 Abs. test box
- 4½ digit Digital voltage meter
- Vacuum meter (0-1 bar vacuum)
- Temperature meter (max. tolerance of 0.1°C)

Required parts for preventive maintenance:

Every 6 months:

#	PARTNUMBER	DESCRIPTION
2	3913-049	membrane vacuum pump
2	3064-041	mixing belt
1	3066-071	100 µl syringe
1	3066-070	1 ml syringe
1	6001-405	tubing set for reagent probe
1	6001-428	tubing set for sample probe
1	3066-083	filter water tank
1	6001-963	wash block

Every 12 months:

#	PARTNUMBER	DESCRIPTION
1	6002-056	water pump membrane + 2 mini valves
1	3053-020	ball bearing sample mixer
1	3053-038	ball bearing reagent mixer
1	3380-018	QI-lamp
1	6001-861	tube assy analyser <> pump unit
1	6001-431	tubing set pipettor unit

Every 24 months:

#	PARTNUMBER	DESCRIPTION
2	6002-042	chamber kit vacuum pump
2	3066-072	pipettor valve

Note that the maintenance requirements depend on the workload of the instrument and the environmental conditions as temperature and humidity.
Individual instruments might need maintenance more or less often than stated here.

4.5.2 Maintenance steps

Time required: approximately 8 hours (excluding customer acceptance tests).

The scheduled maintenance includes the following steps and must be performed in the order as stated here and in accordance with the parts list as stated before:

1. System cleaning procedure
2. Replacement of reagent and sample probe tubing
3. Replacement of ISE sample tubing
   (only for instruments with an ISE unit connected)
4. Revision of vacuum pump
5. Revision of water pump
6. Replacement of mixer belts
7. Checking the pipettor; replacing pipettor valves
8. Replacement of syringes
9. Replacement of water filter
10. Replacement of wash block
11. Checking the cuvette rotor adjustment
12. Checking the lamp adjustment; replacing the lamp
13. Checking the photometer adjustment
14. Checking the reagent needle and cuvette temperature
15. Checking the wash arm adjustment
16. Checking the bellows aspirate volume
17. Checking reagent and sample arm adjustment
18. Checking the needle switch
19. Checking the mixer position
20. Checking reagent and sample rotor adjustment
21. Checking filter wheel adjustment
22. Checking the opto encoder adjustment
23. Perform the dichromate endtest

4.5.2.1 SYSTEM CLEANING

This cleaning procedure cleans the complete tubing of the instrument.
The automatic “clean system” can be started by selecting F5 (Special Functions), F1 (Rotor, System) and CLEAN SYSTEM. The operating instructions are displayed on the screen.

Please note that the clean system procedure will take about 2.5 hours and after this procedure you have to run all programmed tests on a control serum.
When the results are out of limits, the Empty and Fill System procedure must be repeated to remove the remaining cleaning solution.

To prevent contamination, clean the water tank with cleaning solution.
Rinse three times with water afterwards.

During the procedure the operator will have to put the water filter in a bottle with cleaning liquid. The machine will take about 500 ml of it.

4.5.2.2 REPLACEMENT OF REAGENT AND SAMPLE PROBE TUBING

Remove the old reagent and sample tubing and mount the new tubing.

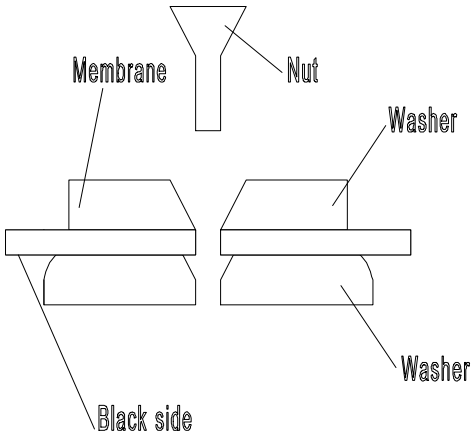
4.5.2.3 REPLACEMENT OF ISE SAMPLE TUBING

This is only relevant when the instrument is equipped with a separate ISE unit.
The length and type of this sample tubing has direct effect to the ISE measurement therefore it is very important to use the correct tubing (code number 1573-002 with a length of 650 ± 2 mm).

1. Remove the ISE needle unit and disconnect the old tubing.
   The easiest way to have access to the tubing of the ISE pick-up arm is by removing the power unit.
2. Mount the new tubing in the same way as the old tubing was mounted.

4.5.2.4 REVISION OF VACUUM PUMP

1) Loosen the eight socket nuts at the pressure and suction side of the pump.
2) Remove the pumphead and gaskets.
3) Remove the old membranes.
4) Mount the new membrane as shown in the figure left. You have to lock the nut by means of using Locktite 243.
5) Mount the pumphead by tighten the socket nuts very equally (like the nuts of a cylinder head of a car).
6) Check the vacuum level and vacuum detector by following the adjustment procedure described in section 5.10.



In case of wear of the plungers you can order a separate plunger kit, which includes the ball bearing and a mounting description (part nr. 6002-041).

In case of wear of the chambers on the pump head a separate chamber kit is available: part nr. 6002-042. Please note that this and the former part should always be replaced in pairs.

4.5.2.5 REVISION OF WATER PUMP

1. Loosen the four screws of the pump.
2. Remove the old pump head, valves and gasket and unscrew the old membrane of the plunger.
3. Place the new revision set, including membrane, rubber mini valves and housing.
4. Tighten the four screws again.

4.5.2.6 REPLACEMENT OF MIXER BELTS

Remove the old belt and place a new one.

4.5.2.7 CHECKING THE PIPETTOR, REPLACING PIPETTOR VALVES

Replacing pipettor valves

It is recommended to replace the pipettor valves every 2 years, but in case of intensive use and depending on the temperature variations in the lab a higher replacement frequency might be necessary.

1. Remove the syringe of the valve that needs replacement.
2. Unscrew the valve from the frame and mount the new valve.
   Make sure the shaft that drives the valve is in the right position!
3. Mount the syringe again.

Spindle drive removal:

1. The two spindles are connected between two (upper and lower) beams.
   It is not recommended to remove the beams from the plate, otherwise a new alignment of the upper and lower beam will be necessary.
2. Loosen the two sprocket set screws from the spindle.
   Push the spindle with the drive assembly a little up until the sprocket comes loose from the spindle and the spindle comes loose from the lower ball bearing.
3. Remove the guide shaft by loosening the two set screws at each end, and slide it out of the beams (see figure 4.4). Be careful with the spring to jump away.
   Remove the circlip, upper ball bearing and lower ball bearing and slide the complete spindle with drive assembly out.

Cleaning the spindle:

1. Turn the spindle out of the drive assembly.
2. Handle the spindle with care (scratches etc.).
   Clean the spindle and drive nuts (still mounted in the drive assembly) with a solvent e.g. refined petrol and a brush.

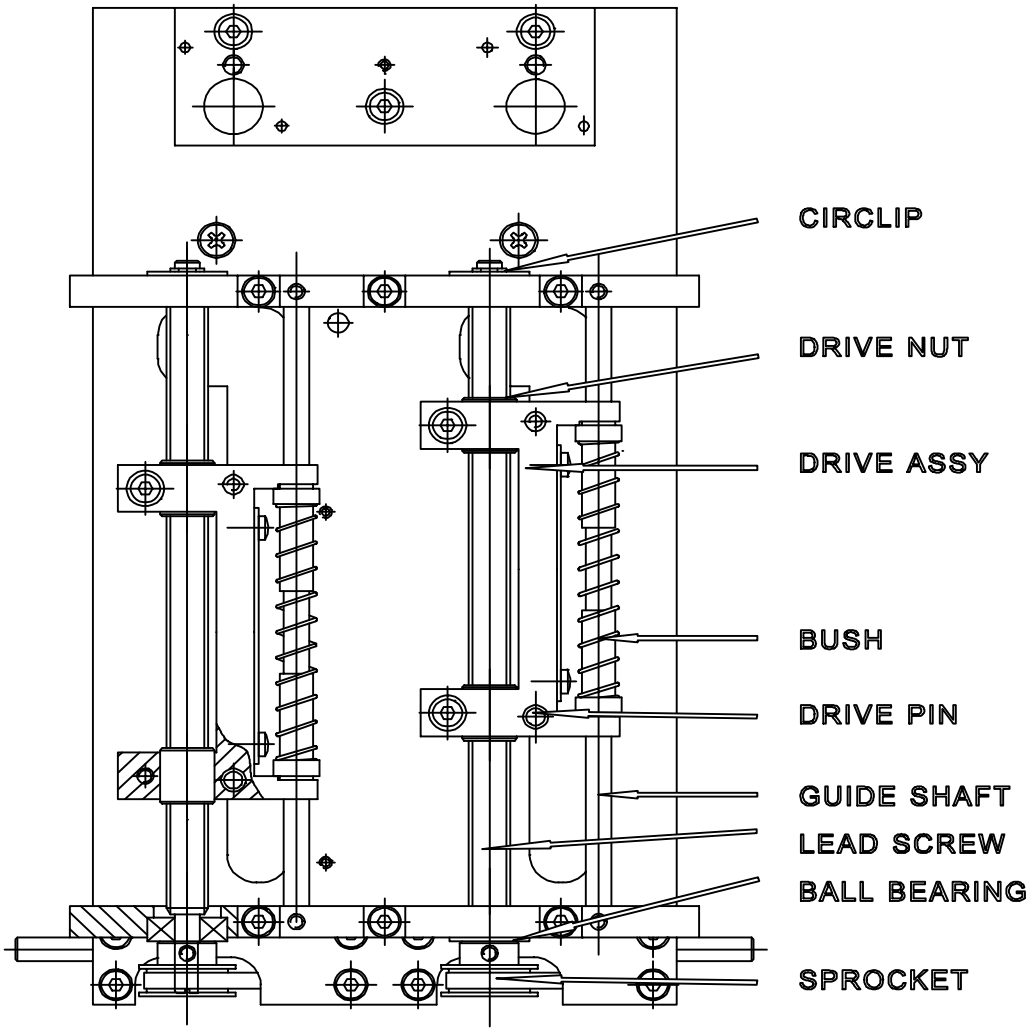


Figure 4.4 - Pipettor drive assembly

Drive nut mounting/alignment:

This alignment is only necessary when the drive nuts are removed out of the drive assembly.

1. Turn both drive nuts over the spindle, measure the distance between the legs of the drive assembly and keep the same distance on the spindle.
2. Insert the spindle (with drive nuts) through the drive assembly, while pushing the drive nuts radial towards the spindle. Slide the spindle with drive nuts until both drive nuts are in the middle of a drive assembly-leg and at both ends you can see the edge of the drive nut.
3. Tighten the screws which keep the drive nuts in place, but do not overtight them. Check to see that the spindle turns well in the drive assembly and has some axial play in the drive assembly.

Spindle mounting:

1. Insert the spindle and drive assy on its place. Install the upper ball bearing with circlip on the spindle and the lower ball bearing in the lower beam. Slide the spindle with drive assembly in its place, while holding the sprocket (with timing belt) in its final position.
2. Pull the drive assembly and the sprocket towards each other to remove all play and tighten the two set screws (note for the flat surface on the spindle).
3. Slide the guide shaft on its place together with the two bushings and spring. Note that the bushings must fit freely.
4. Lock the set screws at both ends. Apply a little grease Molykote PG75 to the bushings, so they will slide smoothly over the guide shaft. Grease the spindle over the full length with Molykote PG75 by applying it with a brush.
5. Check the belt tension and adjust if necessary by loosening the stepper motor screws, sliding the motor in the play of the four mounting holes until the correct belt tension is reached and the tightening the mounting screws.

Now let the drive assembly run up and down by the service menu to spread the grease and remove eventually overspill of grease.
Check if the drive assembly is running smoothly without irregularities.

4.5.2.8 REPLACE SYRINGES

For the procedure of replacement of the syringes see the instruction manual.
Note that the life time of the teflon tips (sealings) can be increased if a very little bit of silicon grease is applied to it.

If only the sealings are replaced the following procedure can be followed:

1. Remove the plunger from the reagent syringe and install a new syringe tip by means of the replacement tool (4100-533). Please note that in the 1 ml syringe there is an O-ring inside the tip, which you have to use with the new tip.
2. Remove the plunger from the sample syringe and install a new syringe tip by means of the replacement tool.
3. Check if the plunger tips are adjusted according the procedure in section 5.11.
4. The glass barrels of the syringes are available under separate part numbers:
   3066-112 Glass barrel for 0.1 ml pipettor
   3066-114 Glass barrel for 1 ml pipettor

4.5.2.9 REPLACEMENT OF WATERFILTER

Replace the filter of the water tank by a new one.

4.5.2.10 REPLACEMENT OF DRYING BLOCK

Replace the drying block (6001-963) of the wash arm by a new one.

Before fixing the screw again lower the wash arm in the service menu with the new drying block already mounted. This assures that the drying block is entered in the position. Fix the screw of the drying block.

4.5.2.11 CHECKING THE CUVETTE ROTOR ADJUSTMENT

The position of the cuvette rotor has to be checked by following the adjustment procedure of section 5.7 of this manual.

4.5.2.12 CHECKING THE PHOTOMETER BOARD ADJUSTMENT

See section 6.3 of this manual.

4.5.2.13 CHECKING REAGENT NEEDLE AND CUVETTE TEMPERATURE

See section 6.5 and 6.6 of this manual.

4.5.2.14 CHECKING WASH ARM ADJUSTMENT AND BELLOWS VOLUME

See section 5.2 and 5.3 of this manual. Always perform wash arm adjustment first!

4.5.2.15 CHECKING THE REAGENT AND SAMPLE ARM ADJUSTMENT

See section 5.4 and 5.5 of this manual.

4.5.2.16 CHECKING THE REAGENT AND SAMPLE ROTOR ADJUSTMENT

See section 5.7 and 5.8 of this manual.

4.5.2.17 CHECKING THE FILTER WHEEL ADJUSTMENT

See section 5.11 of this manual.

4.5.2.18 CHECKING THE OPTO ENCODER ADJUSTMENT

See section 5.12 of this manual.

4.5.2.19 PERFORM THE DICHROMATE END TEST

To check the sample and reagent syringe reproducibility and the stability of the photometer you have to perform a Dichromate test.
A special liquid is used, Potassium Dichromate, which has an absorbance of approximately 8 Abs for the 340nm filter and used as sample.
As a reagent distilled water is used.

Description of the SR3/SR30 test:

Sample: Potassium Dichromate 8 Abs
Reagent: Distilled water

SR3 = 8 Abs sample, dilution 1:100 --> 80 mAbs
SR30 = 8 Abs sample, dilution 1:10 --> 800 mAbs

1) Program the following two tests:

TESTPARAMETERS:

Name:	SR3	SR30
Mode:	Endpoint	Endpoint
Incubation time:	11.5 min	11.5 min
Wavelength:	340nm	340nm
Units:	Abs	Abs
Decimals:	3	3
S-volume:	3µl	30µl
R-volume:	297µl	270µl
R-blank:	No	No
R.Abs.L limit:	-0.100 Abs	-0.100 Abs
R.Abs.H limit:	3.000 Abs	3.000 Abs
Factor:	1	1

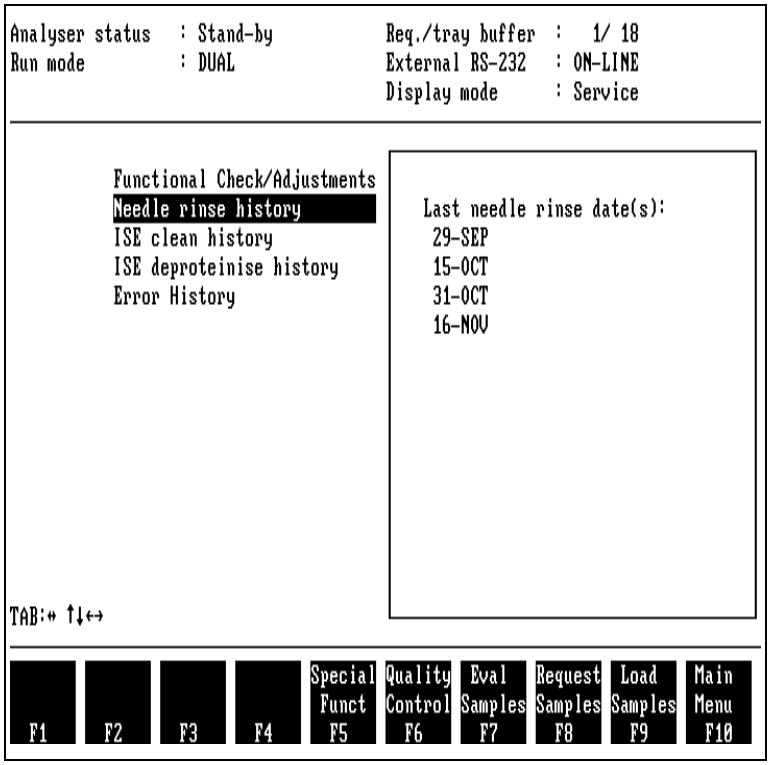
Set all other absorbance and concentration limits to 0 to prevent error messages!

2) Position in the “program reagent positions” menu the reagents for both tests. Place a bottle of distilled water on these positions.
3) Put in the sample rotor on position 1 to 24 tubes with 8 Abs. dichromat.
4) Run for all 24 samples both the SR3 and the SR30 test.
5) Wait until the results are printed and calculate the CV from SR3 and SR30. The CV of the SR30 test should be <1%. The CV from the SR3 test should be <2%

4.6 TEST AND DIAGNOSTIC PROCEDURES

In order to support the service technician a number of test and adjustment routines are implemented in the service menu of the instrument.
This section supplies information about the use and the functions of these menus.

The service menu can be displayed by selecting Special Functions and Service menu. Then the following menu will be displayed:



In this menu you have the possibility to select Functional Check / Adjustments, Needle rinse history, ISE clean history, ISE deproteinise history or Error history.

Needle rinse history
In this menu you can see the last dates of the needle rinse procedures

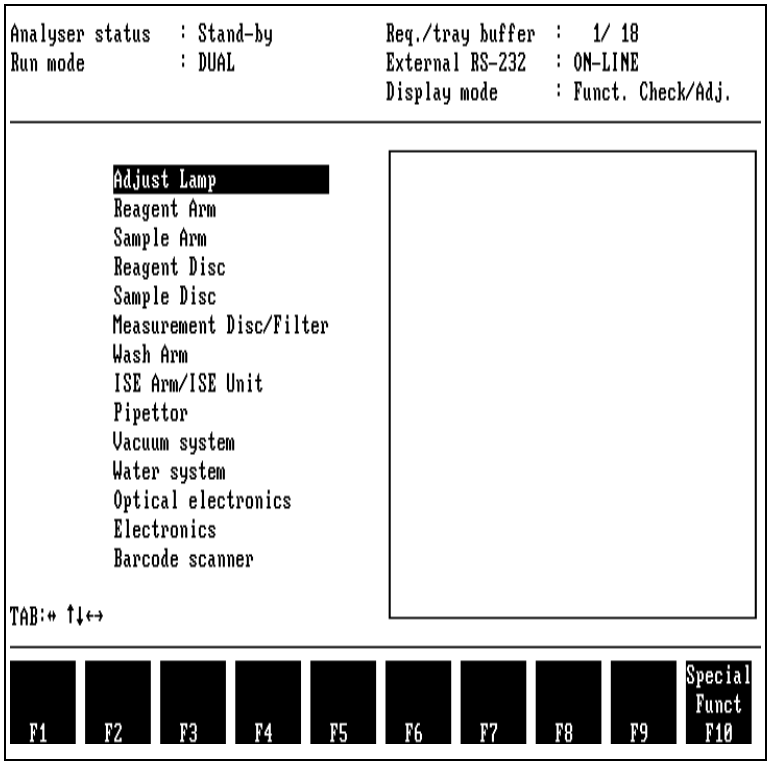
ISE clean history
In this menu you can see the last dates of the ISE clean procedure

ISE deproteinise history
In this menu you can see the last dates of the ISE deproteinise procedure

Error history
In this menu you can inspect all the errors that occurred:

- error code
- error description
- date & time of occurrence
- operator action after the error

If you select Functional Check the following menu will be displayed:

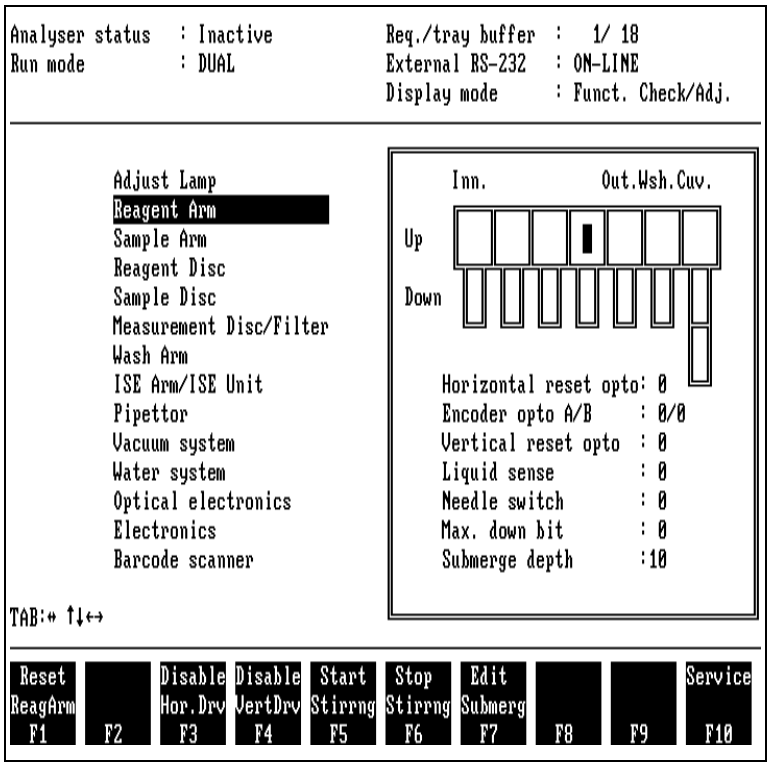


In this menu a number of functional checks can be selected like, adjust lamp, reagent arm, sample arm etceteras.

The different checks can be selected by moving the cursor (with the cursor keys) and press Enter.

For the ADJUST LAMP procedure see chapter 5.

4.6.1 Reagent Arm



First press reset (F1) to activate the reagent arm function, and the reagent arm can be moved with the cursor keys.

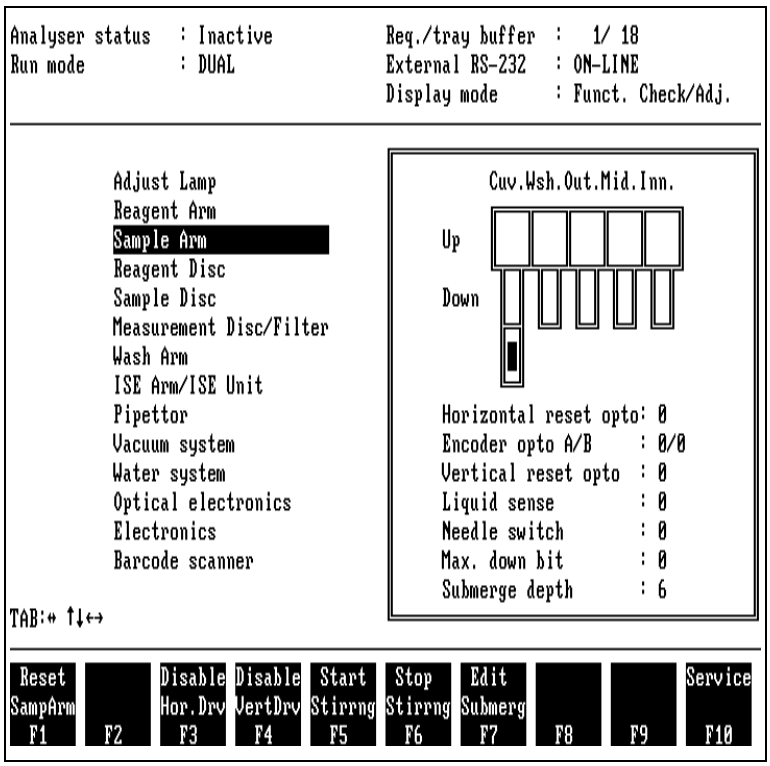
The active state of the following functions are displayed:

Horizontal reset opto switch
Encoder opto switches
Vertical reset opto switch
Liquid sensor (0 = yes = liquid detected, 1 = no = no liquid detected)
Needle switch
Max. down bit (1 = arm is maximal down)

The horizontal steppermotor can be disabled by pressing F3 and the vertical motor can be disabled with F4.
The stirrer motor can be started and stopped with respectively F5 and F6.

Note that for all opto's opto=1 means opto is detecting light, so there is nothing in the light path.

4.6.2 Sample Arm

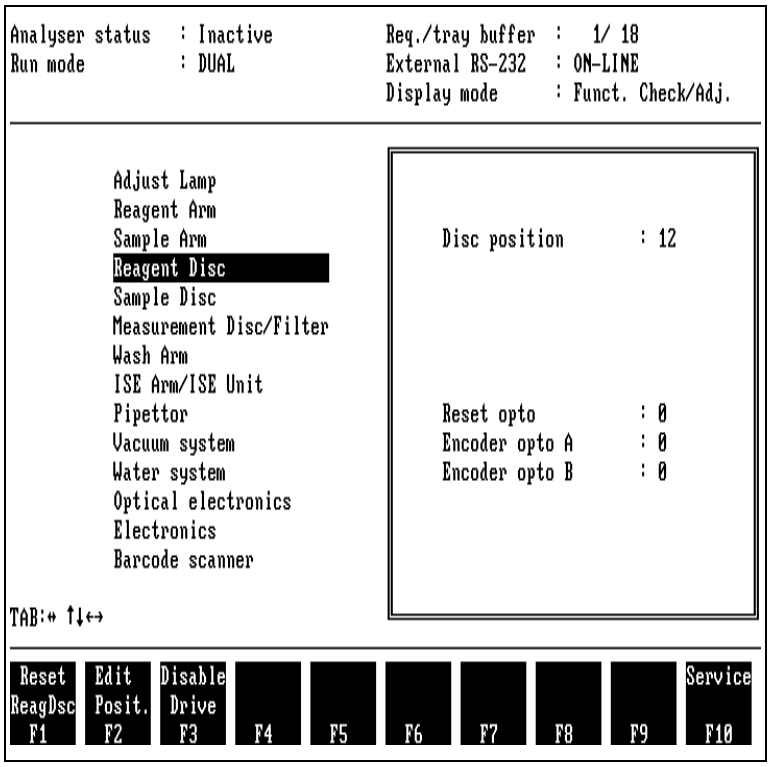


First press reset (F1) to activate the sample arm function, and the sample arm can be moved with the cursor keys.
The active state of the following functions are displayed:

Horizontal reset opto switch
Encoder opto switches
Vertical reset opto switch
Liquid sensor
Needle switch
Max. down bit

Pressing F3 disables the horizontal stepper motor and the vertical motor can be disabled with F4.
The stirrer motor can be started and stopped with respectively F5 and F6.

4.6.3 Reagent Disc

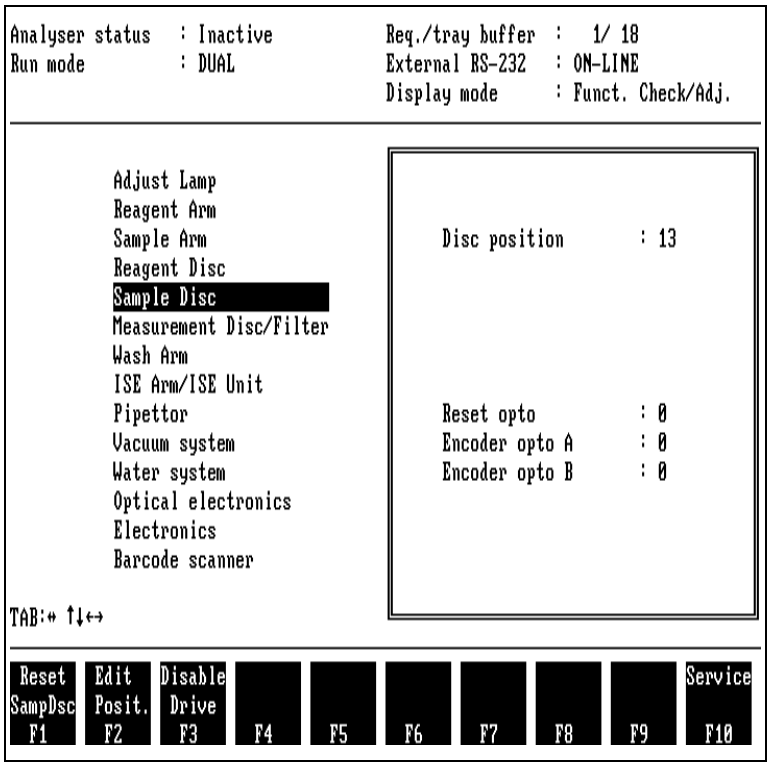


First press reset (F1) to activate the reagent disc function, and then the reagent disc position (32 positions) can be edited with F2.
The active state of the following functions are displayed:

Disc position:
Reset opto switch
Encoder opto switches

The reagent disc motor can be disabled with function key F3.

4.6.4 Sample Disc

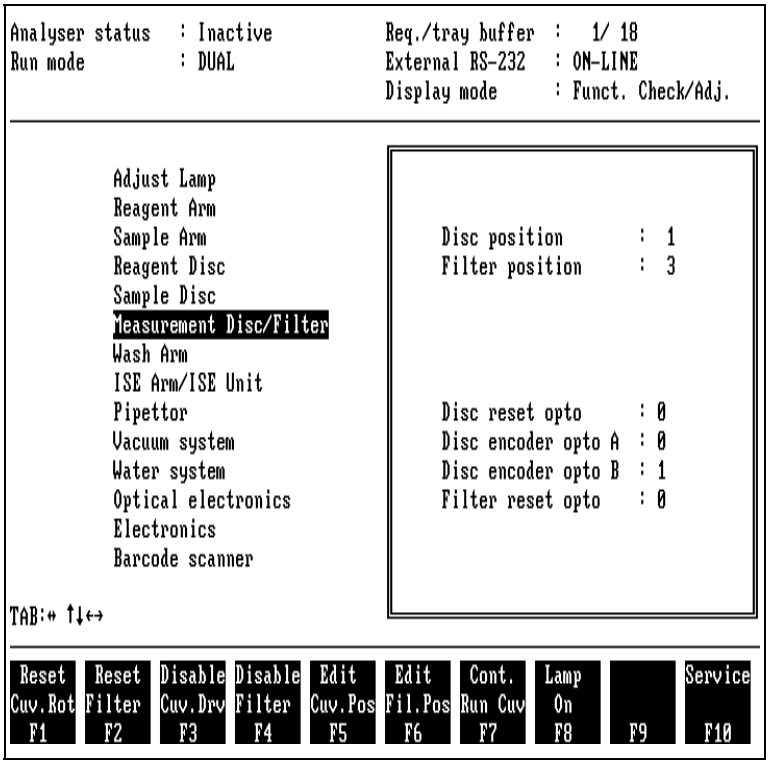


First press reset (F1) to activate the sample disc function, and then the sample disc position can be edited with F2.
The active state of the following functions are displayed:

Disc position:
Reset opto switch
Encoder opto switches

The sample disc motor can be disabled with function key F3.

4.6.5 Measuring disc/Filter



First press F1 to activate the cuvette rotor function, and press F2 to reset the filter wheel and the following functions are active:

F3: Disable the cuvette rotor motor.
F4: Disable the filter wheel.
F5: Edit the cuvette rotor position (cuvette position from 1 to 48 can be entered).
F6: Edit the position of the filter wheel (filter number 1 to 8 can be entered).
F7: Continuous run of the cuvette rotor.
F8: Switch lamp on/off.

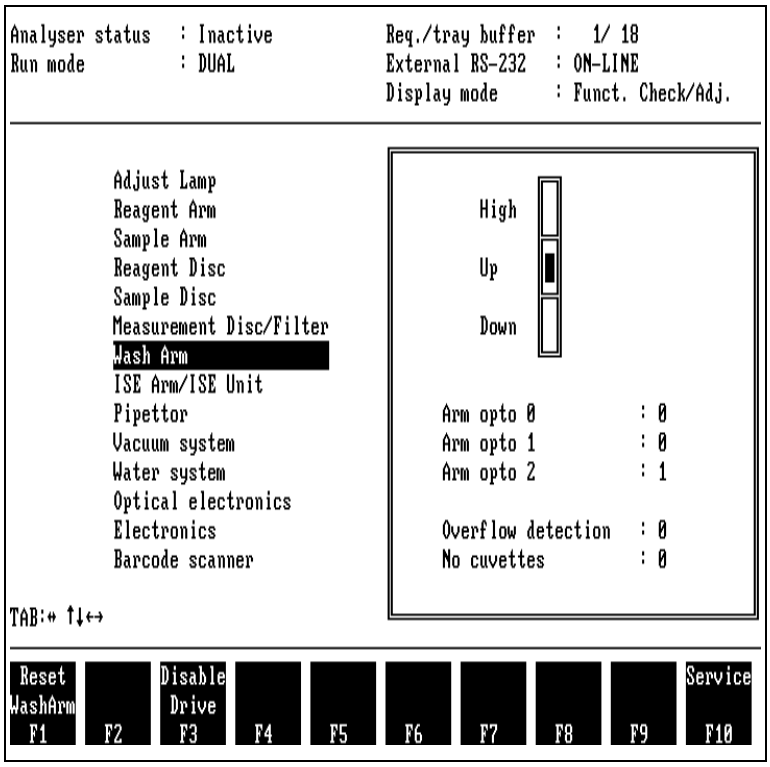
The active state of the following functions is displayed:

Disc position:

Filter position:

Cuvette rotor reset opto switch
Filter wheel reset opto switch
Encoder opto switches

4.6.6 Wash Arm



First press reset (F1) to activate the wash arm function, and the wash arm position can be controlled with the cursor keys.

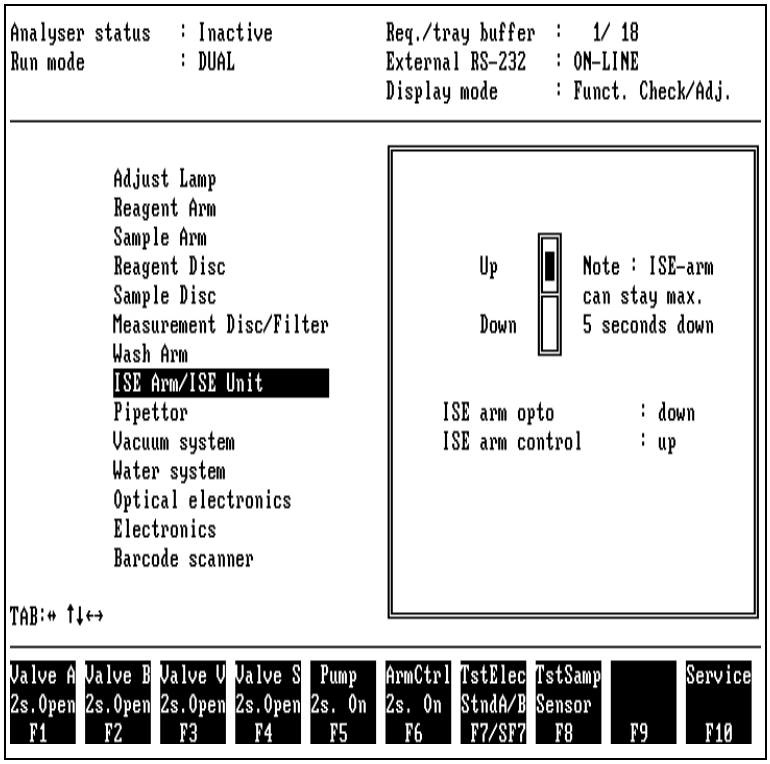
The following active states are displayed:

Arm opto switch high position
Arm opto switch up position
Arm opto switch down position
Overflow detection of the cuvette rotor
No cuvette rotor detection

With function key F3 can the wash arm motor be disabled.

Refer to paragraph 2.3.5 for the function of the various opto's.

4.6.7 ISE arm / ISE unit



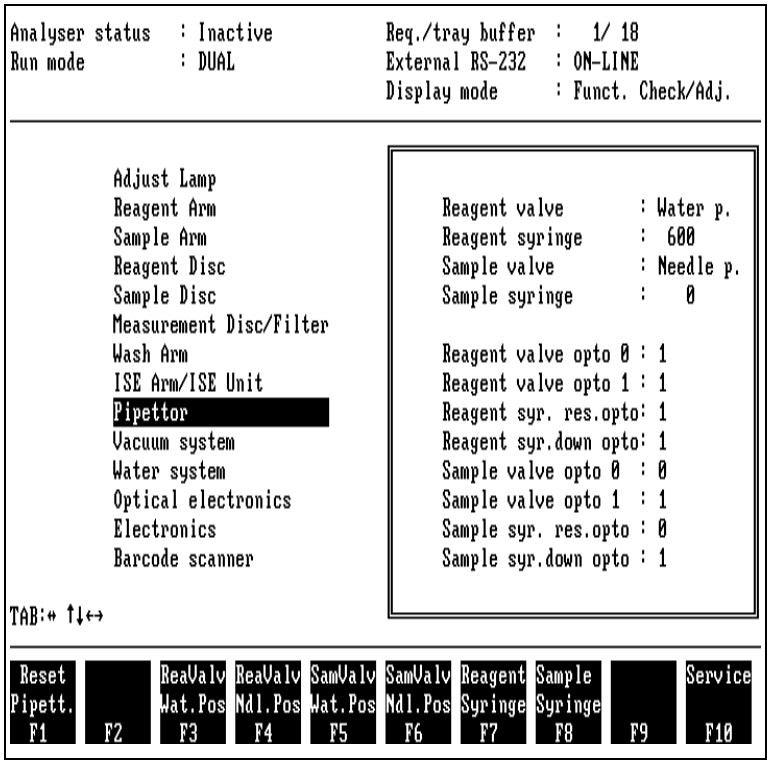
The following test functions are selectable:

- F1: Valve A of the ISE unit will be activated for 2 seconds
- F2: Valve B of the ISE unit will be activated for 2 seconds
- F3: Valve V of the ISE unit will be activated for 2 seconds
- F4: Valve S of the ISE unit will be activated for 2 seconds
- F5: The peristaltic pump will be switched on for 2 seconds
- F6: The ISE unit will send the arm-down command; the ISE-arm-control status will change. The arm itself will not go down!
- F7: The measured voltage of the ISE electrodes for Na, K and Cl will be displayed for standard A.
  When pressing Shift-F7 the same will be displayed for standard B.
- F8: The measured voltage of the sample sensor will be displayed.

For really sending the ISE-arm down you must use the arrow-down key.
The arm will go down for 5 seconds.

For more detailed ISE test facilities we refer to the ISE service manual where the internal test diagnostics are explained.

4.6.8 Pipettor



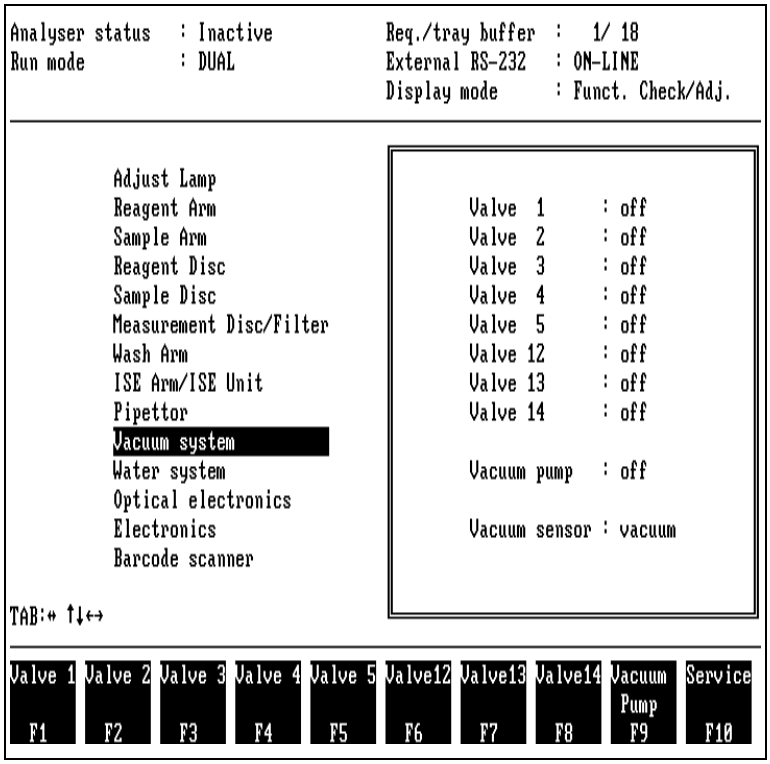
First press reset (F1) to activate the pipettor functions, and the following function keys are active:

F3: Switch the reagent valve to the water position.
F4: Switch the reagent valve to the reagent needle position.
F5: Switch the sample valve to the water position.
F6: Switch the sample valve to the sample needle position.
F7: Program the reagent syringe position in motor steps (0 to 1000 steps).
F8: Program the sample syringe position in motor steps (0 to 1000 steps).

The following states are displayed:

The current positions of the reagent and sample valve.
The current positions of the reagent and sample syringe.
The state of the reagent and sample valve opto switches.
The state of the syringe reset opto's.
The state of the syringe down position opto's.

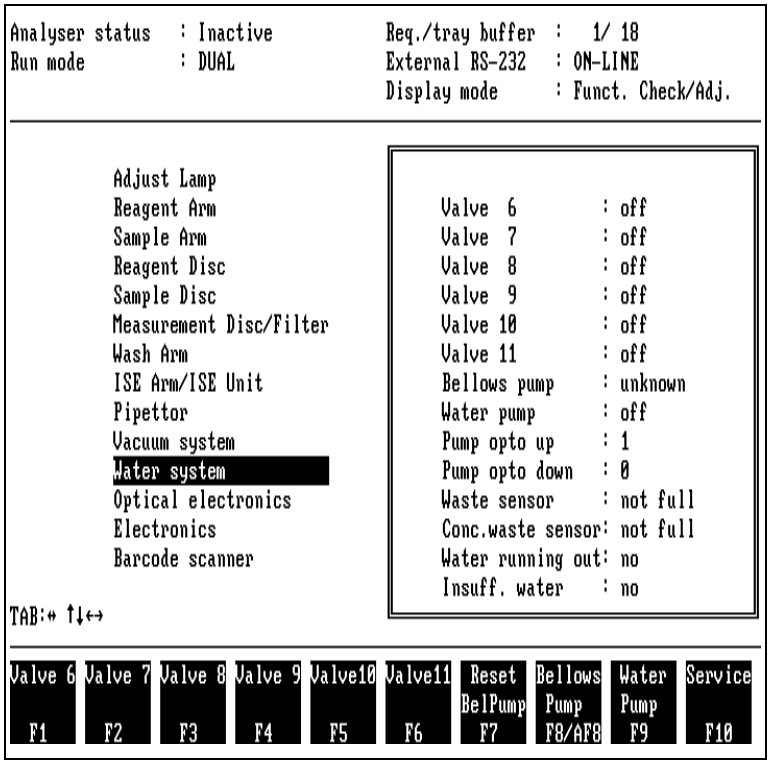
4.6.9 Vacuum System



In this menu all the functional parts of the vacuum system can be controlled and checked. The current state of the valves, pump and vacuum detector is displayed.

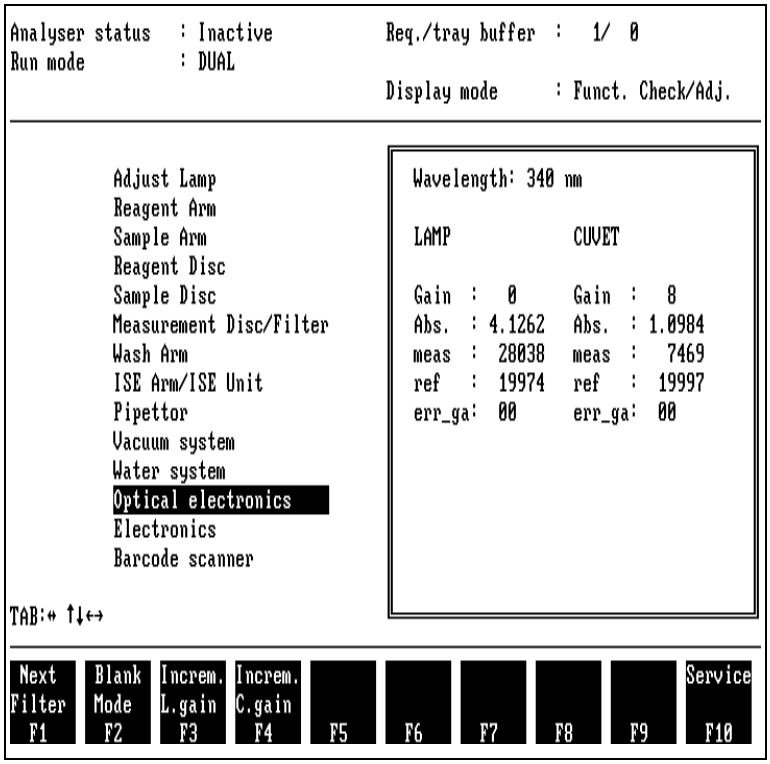
Valve V13 and V14 are for the concentrated waste option.

4.6.10 Water System



In this menu all the functional parts of the water system can be controlled and checked. The active state of the valves, bellows pump with opto's, water pump, waste sensor, concentrated waste sensor and the levels of the water detection system (water running out and insufficient water) is displayed.

4.6.11 Optical electronics



By means of this menu the optical functions can be showed.
Normally you will use this menu together with the lamp adjust menu.
In this screen the following actual values of the reference detector (REF) and the cuvette detector (CUVET) are displayed:

gain (0-15)
Abs. (Absorbance value)
meas. (measured counter value)
ref. (measured value for 100 mV reference signal)

err-ga (error gain signal)

The err-ga (error gain) signal is a read-out of the bit map for the measurement and lamp signal that is generated after blanking.

The bit map is build-up as follows:

error bit	error code
x x x x	No errors
1 x x x	Overrange reference counter (CTC)
x 1 x x	Underrange reference counter (CTC)
x x 1 x	Overrange error (signal)
x x x 1	Underrange error (signal)

Gain bit	gain
0 to F	0 to 15

For example:
err_ga 20 means after blanking an overrange signal is detected with a gain of 0.

The following functions can be performed:

F1: With this function the next filter can be selected.
Each time when you press this button the wavelength will be increased, starting with a wavelength of 340 nm. When you press the SHIFT-F1 a filter of a lower wavelength will be selected.

F2: After pressing this button the instrument will search for a gain high enough to reach a low absorbance value.

F3: After pressing this button the gain of the lamp circuit (LAMP) will be increased. When pressing SHIFT-F3 the gain will be decreased.

F4: After pressing this button the gain of the cuvette circuit (CUVET) will be increased. When pressing SHIFT-F4 the gain will be decreased.

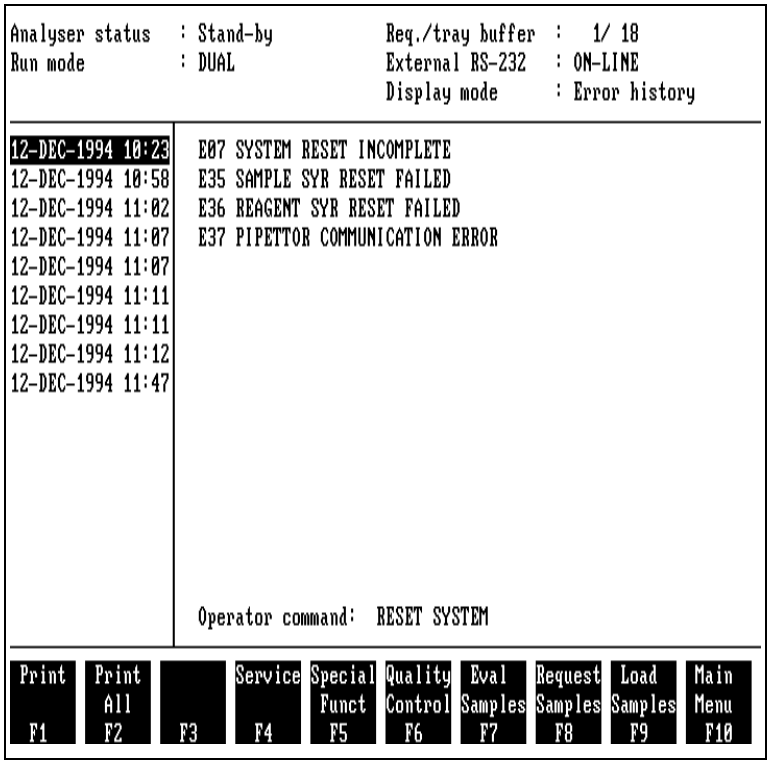
4.6.12 Electronics

In the Electronics menu the adjustment procedure is described for power supply, photometer board, lamp voltage, temperature cuvette rotor and reagent needle.

A detailed description of these adjustments is given in section 6 of this manual.

4.6.13 Error history

The analyser is equipped with a error history storage.
This menu can be entered by selecting in the main menu Special Functions and Service menu.
An example of an error history screen is shown below:



The error history shows the date and time when an error was generated.
When a certain date is selected the hardware error message is displayed; for example the screen above, four errors were displayed (E07, E35, E36 and E37).

The operator action after the error message will also be displayed; in this case the operator has pressed RESET SYSTEM.
A maximum of 100 errors can be stored in the error history.

4.7 SUPPORT TOOLS

The instrument is designed in such a way that a minimum of repair equipment and special tools are required. In most cases the common “standard” tool set will be quite sufficient. Beside this tool set and the special tools described in section 7.3.1 and 7.3.2, the service technician should have a Digital Multi-meter (4½ digit), a vacuum meter (0-1 bar vacuum) and a temperature meter with a tolerance of 0.1°C.

4.7.1 TWO ABSORBANCE TEST BOX

The Two Absorbance test box is a test box that contains a simple circuit consisting of a number of precision resistors, a capacitor and a push-button switch.
By means of this box the photometer board can be calibrated (see section 6.3).

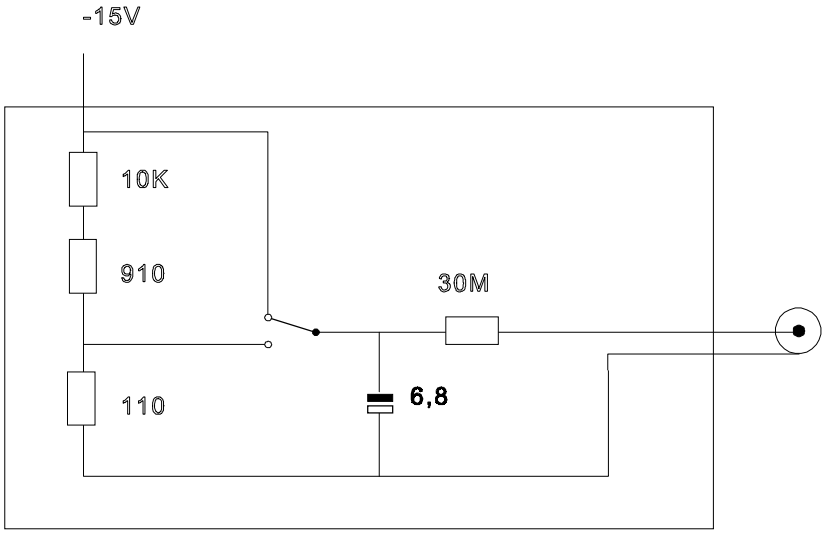


Figure 7.1 - Test box circuit

The operation of the circuit is as follows:

A negative voltage (-15V) is connected to the test-box presenting the input signal to the input amplifier of the photometer board. When the push-button is pressed 1/100 of the original voltage is presented to the input amplifier via the resistors.
This will result in an absorbance of 2.000 mAbs on the display.
The Two Absorbance test box can be ordered from Vital Scientific under code number 6001-283.

4.7.2 MECHANICAL ADJUSTMENT TOOL

There is a special tool available to easily perform mechanical adjustment of the sample and reagent arm (see section 5.8 and 5.9).
The tool consists of a metal block (of 97mm) which supports the reagent or sample arm during these adjustments.
Please note that it is not strictly necessary to have this tool but it will make the adjustment easier.
The tool can be ordered from Vital Scientific under code number 4999-001.

4.8 PRINTED CIRCUIT BOARD REPAIR

The detailed information supplied by this manual provides the opportunity for trouble shooting at component level, however at an economical and quality point of view you can decide to exchange the complete PCB.

The electronic design of the printed circuit boards (A1 to A9) is such that most electronic parts used are commonly available in every well-equipped workshop. However, do not use any components with lower specifications then the original items, because this can affect the performance of the instrument.

A list of components is included with every circuit diagram at section 8 of this manual.

The electronic boards of the computer assembly are designed in such a way that repair is virtually impossible. The reason is the small and compact design, the use of SMD components and the price of the boards. Therefore the components used on these boards cannot be ordered from Vital Scientific, only the complete PCB's are available.

NOTE: More and more components are very sensitive for static electricity. Please take the necessary precautions to avoid damage of the PC-boards.

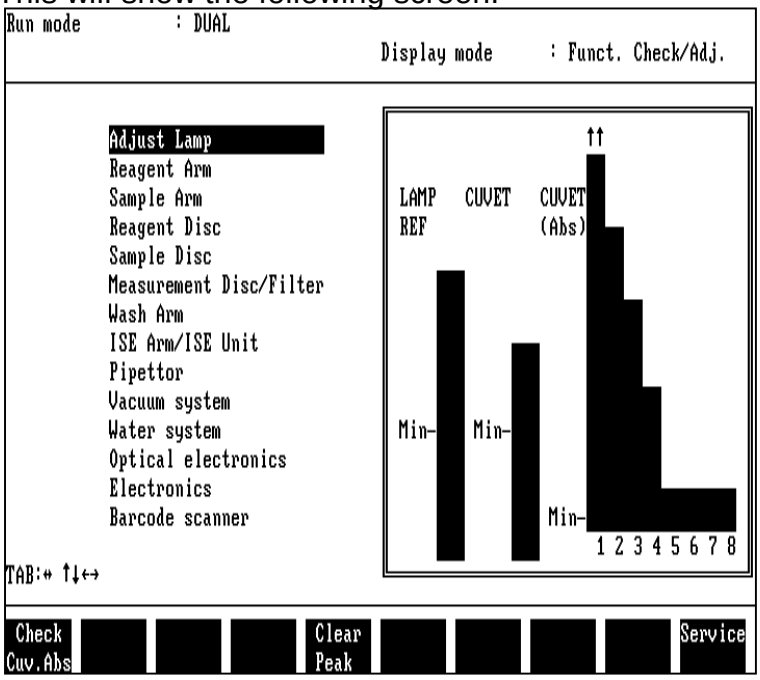
5 MECHANICAL ADJUSTMENTS

5.1 INTRODUCTION

The following paragraphs describe the mechanical adjustment procedures for the main mechanical units.

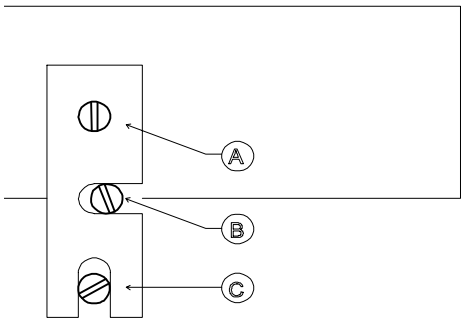
5.2 ADJUST LAMP

The lamp adjustment can be carried out with the help of the ADJUST LAMP function in the service menu. This will show the following screen:



By selecting this function the wavelength is automatically set to 340 nm.

The lamp must be adjusted in such a way that the two bars LAMP REF and CUVET reach a maximum.
These values must be at least as high as the displayed minimum.
The two left bars represent the intensity of light measured by the reference detector (LAMP) and the measurement detector (CUVET).



Procedure:

- Loosen screw **A**.
- Turn screw **B** to the extreme right position.
- Turn screw **C** to lowest position.
- Adjust screw **B** and **C** such, that the bars CUVET and REF reach their maximum.
- Fasten screw **A.**

Note: Normally both the CUVET and REF signals reach their maximum at the same lamp position. If this is not the case, adjust for maximum REF signal and execute the adjustment described below.

Sometimes it is possible to gain some lamp energy by readjusting the cuvette photo sensor. Normally this is only the case when the inner rotor assembly has been removed.

This adjustment is as follows:

1. Loosen screws **D** at top of rotor.
2. Turn the inner rotor assembly slowly clockwise or counter-clockwise and fix housing on position with the highest reading on CUVET.
3. Re-adjust lamp position for maximum signal on CUVET.

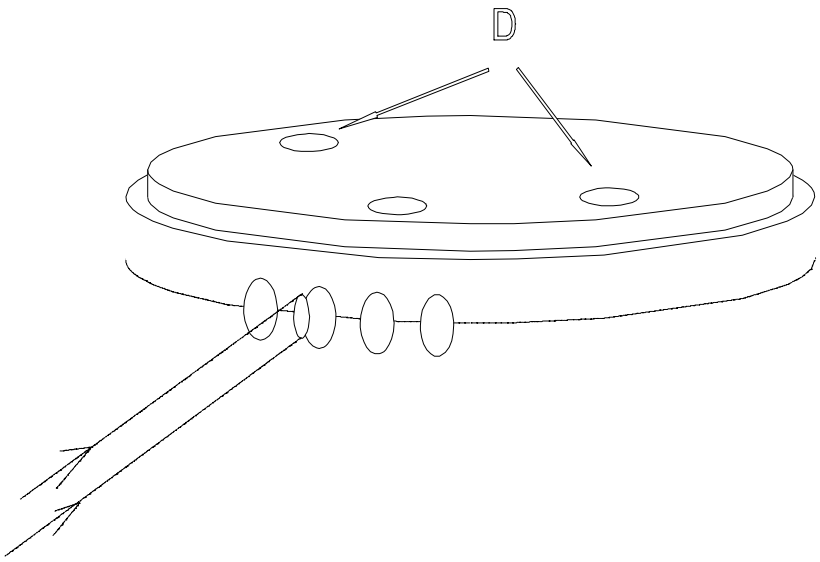


Figure 5.2 - Photo sensor adjustment

Note: So far, when adjusting the lamp and/or sensor position for maximum signal at 340 nm, it does not matter whether there is a cuvette rotor placed or not, or if this cuvette rotor is empty or filled with water.
For the next check a water filled cuvette rotor has to be placed.

The condition of the filters can be checked by pressing F1 (Check Cuv. Abs.) and the absorbance is measured for each wavelength (340 to 620 nm). The absorbance values are graphically displayed on the right side of the screen.
The absorbance must be at least as high as the minimum level.

The actual absorbance and counter values are not displayed in this menu but are shown in a special menu called OPTICAL ELECTRONICS.

5.3 CUVETTE ROTOR ADJUSTMENT

In principle this adjustment has been done at the factory of Vital Scientific.
Only when the measurement rotor has been disassembled it is necessary to check the lightpath and in some cases to re-adjust it. It has no sense to re-adjust unless both adjustments of paragraph 5.2 have been executed first.

Checking the lightspot:

- Remove the cuvette rotor.
- Select in the service menu, “measurement disc/filter” and reset the cuvette rotor [F1] and filter wheel [F2].
- Put some transparent tape (Scotch) on the detector side of the cuvette rotor.
- Select 546nm [F6] and switch on the lamp [F8].
  There will be a green lightspot visible on the tape.
  The lightspot must be in the middle of the hole behind the tape, if not perform the cuvette rotor adjustment.

Cuvette rotor adjust

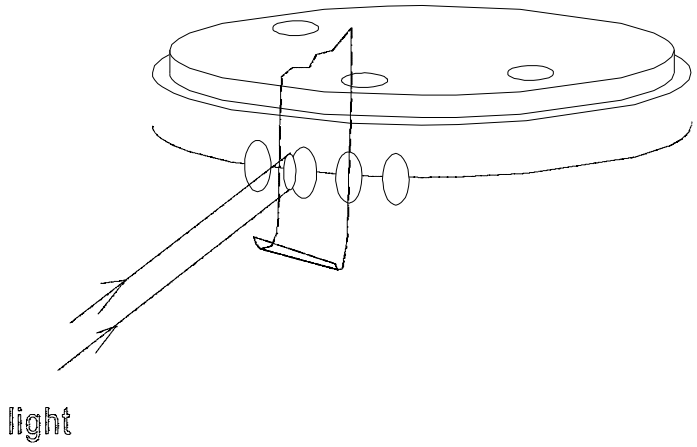


Figure 5.3 - Cuvette rotor adjustment.

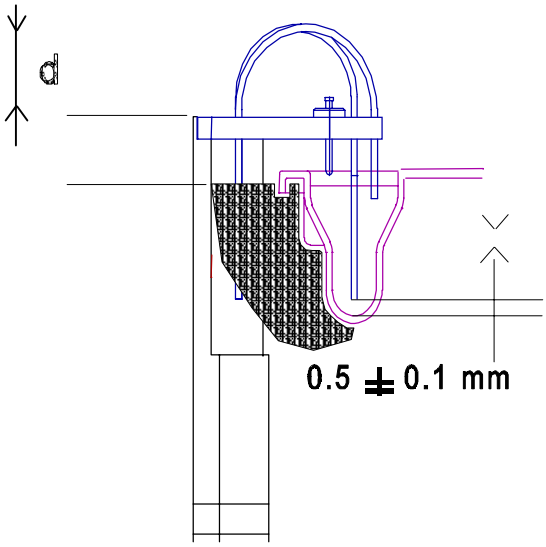
- Open slot A6 (measurement disc / filter wheel motion control board)
- When the lightspot is on the left side:
  Turn hexaswitch 3 on board A6 clockwise (one position higher).
- When the lightspot is on the right side:
  Turn hexaswitch 3 on board A6 counterclockwise (one position lower).

Note: After the adjustment of hexaswitch 3 a reset [F1] of the measurement disk has to be done, in order to make the selected position become active.
If the Motion Control Board is being exchanged remember to copy the position of the old to the new board. The off-factory position can also be found on the sticker on the plastic panel next to the lamp.

5.4 WASH UNIT ADJUSTMENT

The wash unit must be adjusted in such a way that the distance between the needle unit in the down position and the cuvette bottom is 0.5mm (± 0.1).
The checking procedure is as follows:

1) Place a cuvette in the measuring rotor.
2) Select wash arm in the service menu.
3) Reset the wash arm [F1].
4) Move wash arm to the down position [↓] (in the service menu).
5) Measure distance **d**.



6) Disable wash arm [F3]
7) Push the wash arm downward until the needles touch the cuvette bottom.
8) Measure distance **d** again.
   The difference between **d5** and **d8** must be 0,5 mm ± 0,1mm if not, adjust wash arm. The adjustment procedure is as follows:
9) Loosen the locking screw.
10) Adjust the setscrew in such a way that the distance between **d5** and **d8** becomes 0,5 mm ± 0,1 mm.
    360°cw = +0,5 mm 360°ccw = -0,5 mm

You have to check every adjustment by repeating step 3 through to 8.

Make sure that when turning the set screw counterclockwise that the wash arm board is really going down and not the screw coming up.
This can be done by pushing on the screw with the screwdriver.

11) Tighten the locking screw.

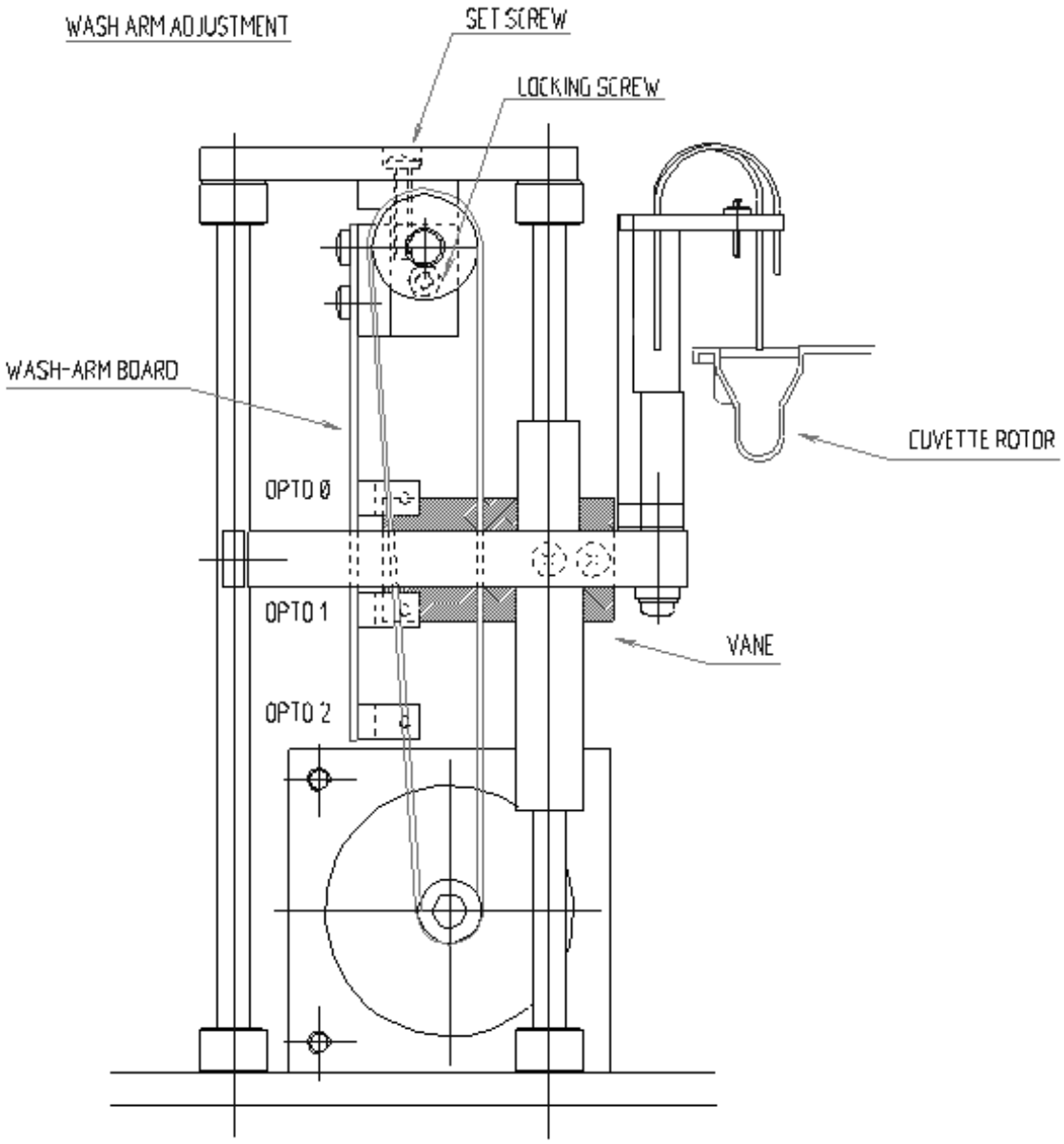


Figure 5.5 - Wash arm adjustment

Checking the cuvette detection:
Every time the wash arm is reset it goes down completely to check if the cuvette rotor is present. If there is no rotor the vane (see figure 5.5) will be in the fully down position (opto 2) and not in opto 1 any more.

Before checking the cuvette detection the wash arm adjustment must be checked.

12) Select wash arm service menu
13) Reset the wash arm [F1].

Check if “no cuvettes” is “0”:
if not :

13.1) Disable the wash arm [F3].
13.2) Push the wash arm downward until the needles touch the cuvette bottom.
13.3) Check if opto 1 is “0”, if not, bend opto 1 carefully downwards in such a way that it just switches to “0”.

14) Remove cuvette.
15) Reset wash arm [F1].

Check if “no cuvettes” is “1”.
If not, check if opto 1 is in right position and reset the wash arm again.

5.5 BELLOWS PUMP ADJUSTMENT

The bellows pump consists of 6 bellows (one not used) which aspirate or dispense simultaneously. One bellow (on the motor side) controls the wash water of the sample needle. Four bellows control the wash water in the 4 cuvette wash positions. The optimum cycle volume for the pump is 400 µl and can be adjusted by means of shifting beam A towards respectively away from the bellows.

To decrease the volume:
loosen screw 1 and 2
move beam A away from bellows
tighten screw 1 and 2

To increase the volume:
loosen screw 1 and 2
move beam A towards bellows
tighten screw 1 and 2

The screws are accessible through a slit in the baseplate.

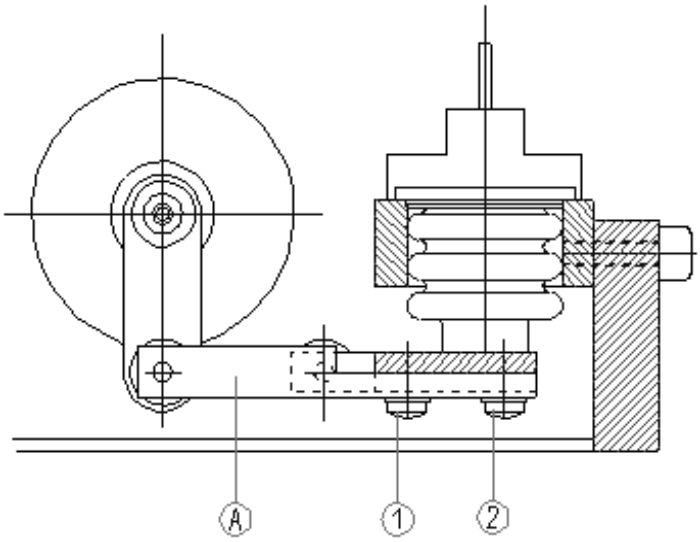


Figure 5.7 - Bellows pump

After adjustment of the pump volume, you have to check if the aspirated volume is correct. The best way is to check this during a wash cycle.

When the wash arm is down and the cuvette is filled the shortest needle C must be approximately 1 mm below the water level. When checking this, be sure the wash unit adjustment is OK!

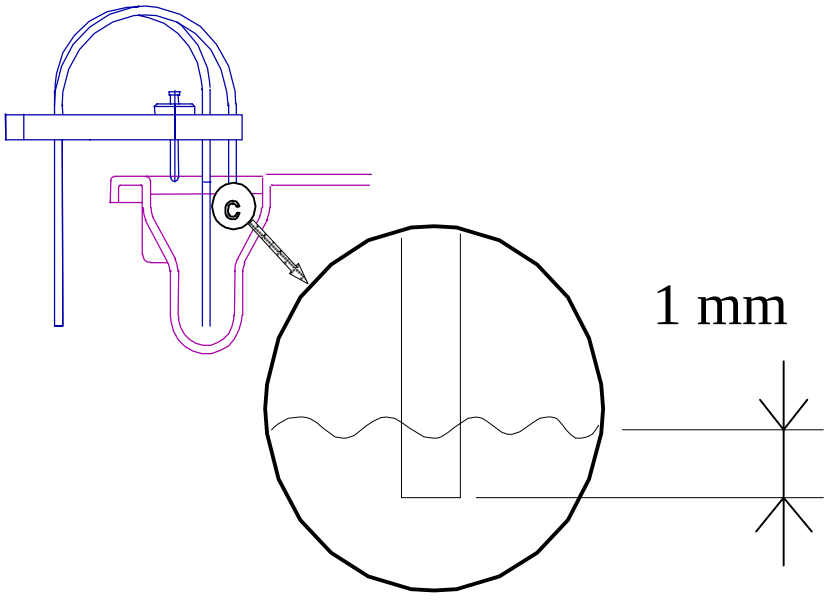


Figure 5.8 - Checking the pump volume

5.6 SAMPLE ARM AND REAGENT ARM ADJUSTMENT

For all arm adjustments the covers of the arms must be removed.

Small horizontal arm adjustment.

1) In the service menu reset the arm and move the arm to the wash position (horizontally and vertically)
2) Loosen the larger, conic screw on top of the arm and loosen the smaller screw.
3) Adjust the arm in a way that the needle is in the centre of the wash position.
4) Fasten the smaller screw well
5) Fasten the larger, conic screw well.

COMPLETE ARM ADJUSTMENT

This adjustment is only necessary when a repair on this part of the arms has been carried out. If only a small horizontal adjustment is necessary, for example because the needle has bent a little bit, then carry out the small horizontal arm adjustment.

The height of the arms is determined by ring G (see figure 5.6), the horizontal position is determined by the clamp assembly B. However, in order to readjust the height the clamp assembly also has to be loosened. This means that after performing the vertical adjustment the horizontal adjustment must be performed too.

Initial Check

1) Reset the sample arm [F1].
2) Check if the free space between upper side of clamp assembly B and bottom side of swing unit A is ±0.5 mm.
   If not, shift the reset opto a little up or downwards (by means of the two fixing screws). Reset the sample arm and check again if the free space is sufficient.
3) Check if the distance between the top of the mechanical assembly and the bottom of the arm (***without*** plastic cover) is 97 mm.
   If not, the vertical adjustment must be carried out.

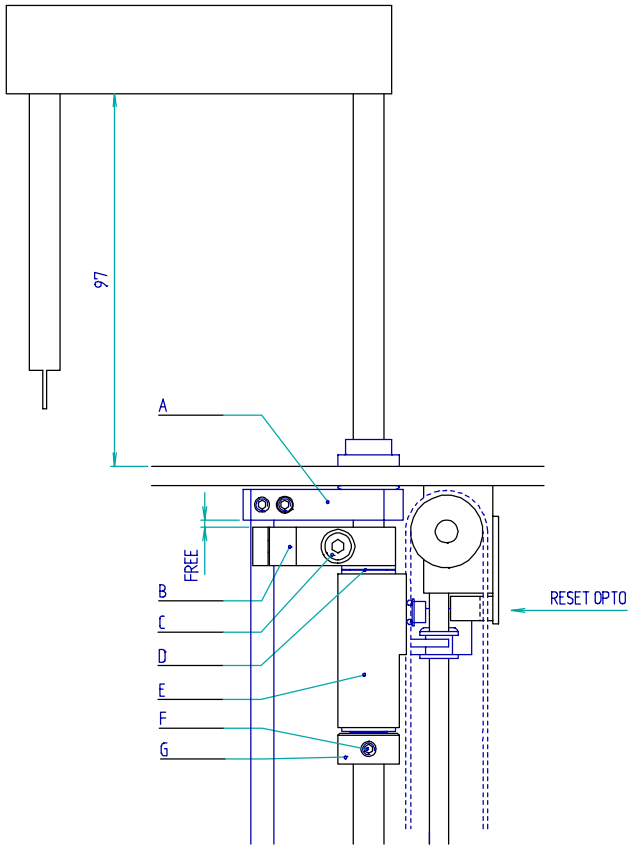


Figure 5.6 - Arm adjustment

Vertical adjustment

4) Loosen and remove screw C of the clamp assembly, apply some Locktite 243 and mount again. Do not fasten the screw.
5) Loosen screw F while holding ring G with your hands and adjust the shaft of the arm so, that the distance is 97 mm. Press ring G firmly upwards against block E and fasten screw F firmly

After this adjustment the horizontal adjustment ***must*** be performed.

Horizontal adjustment

6) Reset the arm (F1)
7) Loosen screw C of the clamp assembly A and apply some new Locktite
8) In the service menu move the arm to the wash position (only horizontally!)
9) Disable vertical drive [F4].
10) Push the arm down by hand just above the wash position and adjust the arm so, that the needle is in the centre of the wash position.
11) Firmly push ring G, block E and clamp assembly A against each other and fix screw C very well.

12) Reset the arm and check the needle in every position (cuvette, wash position and cups / bottles)

Pressure release screw for guiding bearings

By means of the screw in the clamp assembly you can release the pressure of the guiding bearings on the shaft.
After fastening the clamp assembly always check this pressure:

- Disable the vertical drive of the arm
- Check the pressure of the bearings on the shaft by moving the arm up and down by hand
- If this movement is difficult release the pressure by turning the little screw clockwise and check again.
- Do not release the pressure too much, this causes play!

CHECK THE MIXER POSITION:

1) Reset reagent arm [F1] and move reagent arm to the mixer position [↓][↓].
2) Start the mixer [F5] and check if the needle touches the sides of the cuvettes. If it touches (noisy!):
    - Loosen the 2 screws on top of the mechanical assembly, with which the mixer assembly is mounted in the mechanical assembly.
    - Shift the mixer assembly such that the noise of the needle touching the cuvette disappears.
    - Fasten the 2 screws again.
3) Reset the sample arm [F1] and move sample arm to the mixer position [↓][↓].
4) Repeat step 2

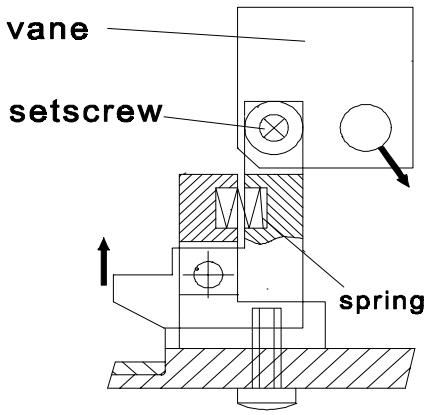
NEEDLE SAFETY SWITCH ADJUSTMENT

The instrument is provided with safety switches (optical) on the reagent arm and on the sample arm to detect obstruction, especially when moving down.

Optical needle switch adjustment

1) Select Sample Arm or Reagent Arm in the Service Menu.
2) Reset and disable the horizontal and vertical movement of the arm.
3) Move the arm so that the needle tip just touches the surface of the working table.
4) Now move down the arm very carefully, in a way that you can feel the steps of the stepper motor.
5) After the 2nd or the 3rd step of the stepper motor the screen should say “needle switch: 1”

If this is not the case you must adjust the vane of the switch (see figure below) in such a way that the switching point becomes within the range of 2 or 3 steps.



5.7 REAGENT ROTOR ADJUSTMENT

1) Place a reagent bottle in position 1 of the reagent rotor.
2) Select in the service menu, reagent disc and reset the rotor [F1].
3) Select in the service menu, reagent arm and reset the reagent arm.
   Turn the reagent arm to position 1 (above bottle 1) [←][←][←].
   Disable the vertical drive [F4]. Push the reagent needle into the bottle and check if the distance **d** is the same on each side, see drawing below.
   Take radial play of bottle in rotor into account!

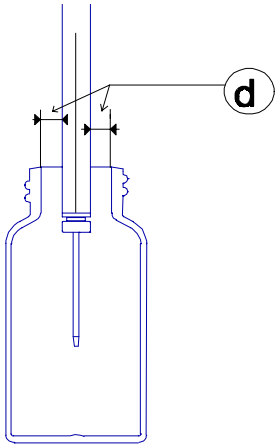


Figure 5.8 - Reagent rotor adjustment

6) When this is not the case, adjust the rotor by means of the four clamping screws **A**, see figure 5.9.

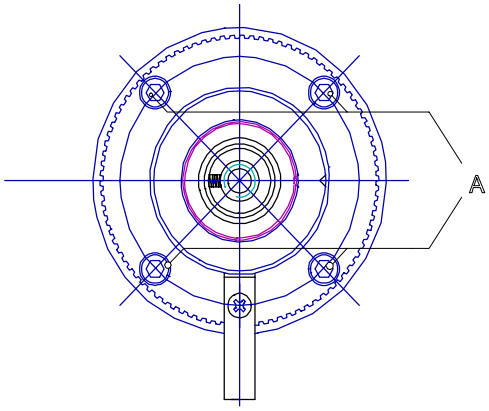


Figure 5.9 - Reagent rotor adjustment

5.8 SAMPLE ROTOR ADJUSTMENT

1) Select in the service menu, sample arm and reset the sample arm [F1].
2) Turn the sample arm to position 1 (above sample cup 1) [→][→].
3) Disable the vertical drive [F4].
4) Push the sample arm downwards and check if the needle housing is in the middle of the sample cup. Take radial play of cups in rotor into account!
5) When this is not the case, adjust the rotor by means of the four clamping screws **A**, see drawing below.

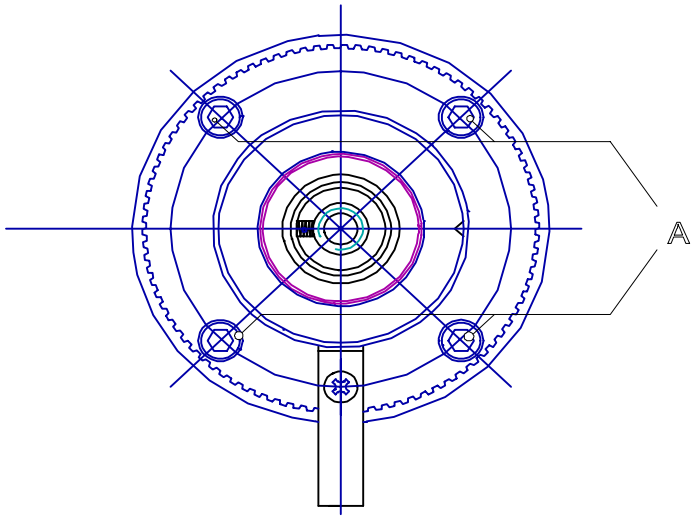


Figure 5.10 - Sample rotor adjustment

5.9 VACUUM SENSOR ADJUSTMENT

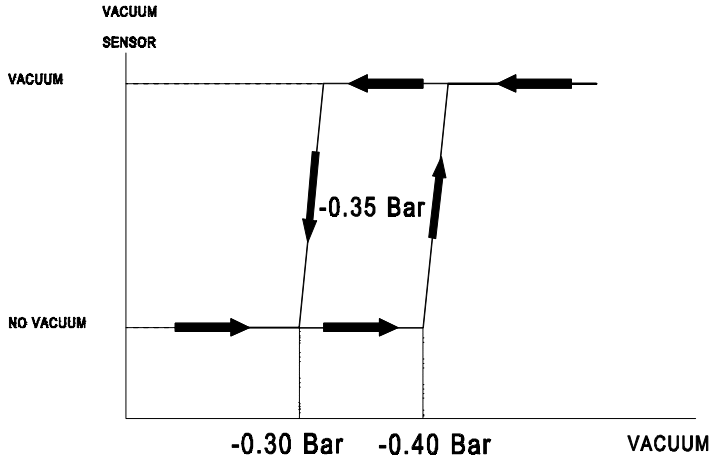
When the instrument is in the 'active' state the vacuum pump is always running. However, the vacuum level varies continuously due to opening and closing valves while the vacuum cask works as a buffer.

The vacuum sensor will become "0" when the vacuum level becomes too low. The actual indication of the sensor can be checked in the service menu VACUUM SYSTEM.

The adjustment of the vacuum sensor has to be done with a vacuum meter. The procedure is as follows:

1) Select in the service menu, vacuum system.
2) Connect the vacuum meter between tube connector 2 at the rear of the instrument (green, vacuum) and the tube going to the vacuum sensor.
3) Select in the service menu OFF for all valves [F1 to F8], and switch on the vacuum pump. The vacuum level must be ≥-0.7 bar. After switching off the vacuum level it may not reduce more then 0.1 Bar in 90 seconds.
   When this is the case there is a leakage in the vacuum pump or in the tubing.
4) Switch on the vacuum pump again and cover the rinsing place of the sample needle with your finger.
5) While keeping your finger on the rinsing place switch on valve 2 and valve 4. Let the vacuum escape little by little by means of lifting your finger a little bit and check that the vacuum sensor switches from VACUUM to NO VACUUM at a level of about -0.3 bar.

   If not: adjust the switch level of the vacuum sensor by turning the setscrew, accessible from the rear of the instrument (remove back cover).
   Turning clockwise = increasing switch level.



6) Also check at which level the detector is switching from NO VACUUM to VACUUM. This must be at approx. -0.40 bar.

5.10 SYRINGE TIP ADJUSTMENT (100 µL ONLY)

The syringe tip adjustment has to be done when a complete new syringe or a new plunger is placed. The adjustment of the sample syringe is as follows:

1) Remove the complete syringe from the dispenser unit. (Use the CHANGE SYRINGE menu.)
2) Loosen the set screw of the plunger stop and adjust the plunger in such a way that the plunger stop is against the bottom of the glass barrel and the top of the teflon tip is in line with the top of the syringe.

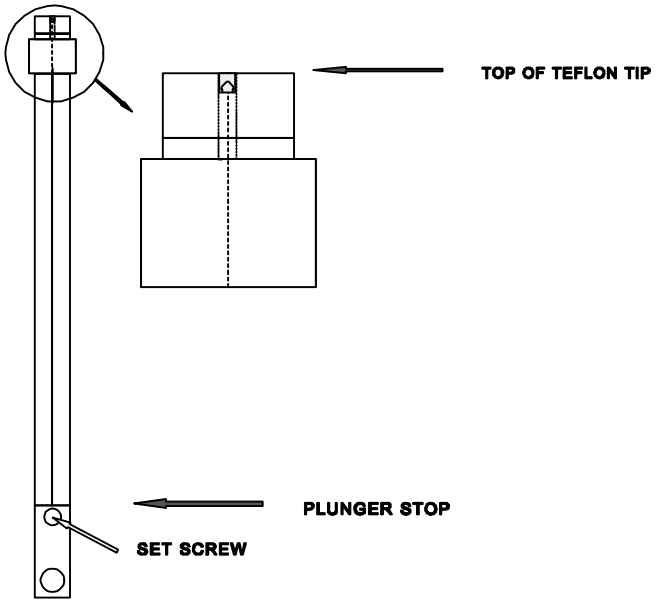


Figure 5.12 - Sample syringe tip adjustment

3) Fix the adjust screw again.
4) Place the syringe in the dispenser unit.

5.11 OPTO ENCODER ADJUSTMENT

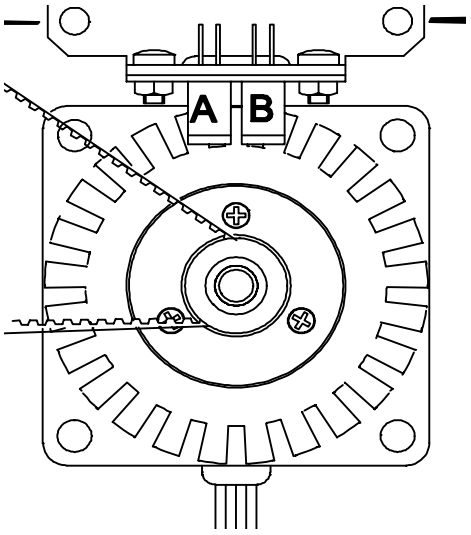
The opto encoder checks the strobe disk position.
The position of the two opto's is adjusted at the factory and only has to be re-adjusted when the two mounting screws have been loosened.

The strobe disk is used to check all horizontal rotations:

- measurement disk
- sample disk
- reagent disk
- sample arm horizontal
- reagent arm horizontal

Check opto encoder position:

1) Select drive to be checked in the service menu.
2) Reset drive.
3) Disable drive.
4) Turn the strobe disk by hand step by step and check the reading on the screen for the following:



step	A	B
n	0	0
n_{+1}	0	0
n_{+2}	1	0
n_{+3}	1	0
n_{+4}	1	1
n_{+5}	1	1
n_{+6}	0	1
n_{+7}	0	1

Every two steps of the strobe disk
there must be one change of the opto's.

Note:
Every time it takes about a second before the screen displays the actual situation. Therefore after every step wait at least 1 second for the screen to update.

If the code of the opto's is not changing properly it is necessary to reposition the complete opto encoder assembly.

The distance between the opto's must be 1.6 mm and is fixed (glued).

6 ELECTRICAL ADJUSTMENTS

6.1 INTRODUCTION

The following paragraphs describe the electrical adjustment procedures.
The adjustments are carried out according to the text on the help screens of the service menu (submenu ELECTRONICS).
The description of the service menu is given in section 4.4 of this manual.

To perform the electrical adjustments the following equipment is required:

- Digital voltmeter (4 ½ digits)
- 2 Absorbance test box
- Temperature meter (accuracy of 0.1 °C)

6.2 CHECK POWER SUPPLY VOLTAGES

Select in the service menu, ELECTRONICS page 1.
In this menu the complete description for the adjustment is given.
Perform all adjustments as indicated in the 8 pages.
The <Page Down>key steps to the next page.

Page 1 Power supply voltage check
Follow the instructions on the screen

Page 2 Lamp voltage adjustment
Follow the instructions on the screen

Page 3 Temperature check cuvette rotor
The O.K. on the screen only indicates that the instrument reaches its set temperature. It might take a few minutes before the instrument reaches this temperature.
To check if the temperature really is O.K. see paragraph 6.4

Page 4 Reagent arm thermostatting
Wait for the indication on the screen to change to O.K.

Page 5 Input amplifier offset adjustment
Follow the instructions on the screen

Page 6 Discharge buffer offset adjustment
Follow the instructions on the screen

Page 7 Output comparator offset adjustment
Follow the instructions on the screen. It is not necessary that you adjust to exactly 1.5V. The potentiometers must be adjusted in such a way, that the outputs of the opamps switch over from about 0V to about 5V.
On this switching point you will find that the reading of the meter is unstable, but this is normal behaviour

Page 8 Reference counter adjustment
Follow the instructions on the screen.
Switching on the sound (F9) will make the adjustment easier.
You will hear a beep while doing the adjustment.
The lower the tone, the closer you are to exactly 20.000.
Adjust until the beep does not sound any more.

6.3 PHOTOMETER BOARD ADJUSTMENT

Two Absorbance reference adjustment:

- Open slot A9 and remove the metal shielding.
- Select in the service menu OPTICAL ELECTRONICS.
- Connect the “Two Absorbance testbox” to PL3.
- Connect and the power-cable to TAB3 (-15V) and push BLANK [F2].
- Read the LAMP MEAS value on the screen and write down.
- Press the button on the “Two Absorbance testbox” and keep it depressed.
- Read the LAMP MEAS value again and write it down.
  The difference must be 20000 (±100); if not adjust with P1.
- Connect the “Two Absorbance testbox” to PL4
- Connect the power-cable to TAB3 (-15V)
- Select BLANK [F2].
- Read the cuvette measurement value on the screen and write it down.
- Press the button on the “Two Absorbance testbox” and keep it depressed, the difference for the cuvette measurement value must again be 20000 (±100).
- Mount the metal shielding.
- Connect PL3 and PL4 again.
- Close slot A9

6.4 TEMPERATURE ADJUSTMENT CUVETTE ROTOR

Select in the service menu, ELECTRONICS, page 3.
In this menu the complete description for the adjustment is given.

Temperature adjustment of cuvette rotor:

First check if the cuvette detection is correct in the service menu.
The status of the analyser should be “INACTIVE”, because when the status is “HALTED” the Peltiers of the cuvette rotor are not activated.
The screen must show: CUVETTE TEMPERATURE: OK.
This adjustment must be done in the main menu.
You have to run a wash and fill cycle. During the run all the covers must be mounted and the cuvette cover must placed.
After the wash and fill cycle the following adjustment can be done:

- Measure the temperature in the cuvette rotor with a very small temperature probe. When the probe has too much mass it will cool down the cuvette and a good indication of the temperature is not possible anymore.
- Place the temperature probe in the cuvette that is in the lightpath.
- Adjust the temperature to 37.5°C (± 0.2) by means of P3 (which is mounted behind the front plate). Turning P3 360° clockwise means, as an indication, an increase of temperature of 0.4 °C.

After an adjustment of the temperature repeat the wash and fill cycle and check the new set temperature!

6.5 ADJUSTMENT OF THE PLL (LIQUID SENSE)

This procedure describes the adjustment of the PLL circuit for liquid detection.
The potentiometers for this adjustment can be found just behind the tube connectors for the sample and the reagent arm, if you remove the top cover (next to the printer).
The procedure is the same for both arms. Most important is to prevent that the PLL circuit is too sensitive and thinks it aspirates liquid while in fact it does not.
By means of surrounding the needle by full cups / bottles the capacitive coupling between needle and rotor is made very high. The tube and the liquid act as dielectricum Even then the needle may not sense liquid erroneously.

Liquid sense sensitivity adjustment (PLL circuit)

SAMPLE ROTOR:

- Turn “P2” to the extreme left (CCW) position (very insensitive).
- Put a dry and empty Sample tube in the Rotor on position “2”, surrounded by empty paediatric adapters on position’s 1, 3, E3, 4, W, B and S1.
- Select in the service menu, sample arm and reset the sample arm [F1].
- Turn the sample arm into the Sample tube on position “2” [→][→][→][↓].
- The liquid detection has to be “NO”.
- Turn “P2” to the right (CW) position until the liquid detection changes to a “YES”. Now turn “P2” to the left (CCW) until the bit changes again to a “NO”.
- Turn “P2” 360° (one complete turn) to the left (CCW).

REAGENT ROTOR:

- Turn “P1” to the extreme left (CCW) position (very insensitive).
- Put an empty 5ml bottle on position “29”, surrounded by water filled bottles on position’s 15, 24, 25, 26, 27, 29, 30, 31, 32, 1 and 16.
- Select in the service menu, reagent arm and reset the reagent arm [F1].
- Turn the reagent arm into the empty bottle on position “28” [←][←][←][←][↓]. The liquid detection has to be “NO”.
- Turn “P1” to the right (CW) position until the liquid detection changes to “YES”. Now turn “P1” to the left (CCW) until the bit changes again to a “NO”.
- Turn “P1” 360° (one complete turn) to the left (CCW).

Check also for some other positions if the liquid sense is working well.

7 ERROR HANDLING

7.1 ERROR CODE LIST

In the analyser a large number of error messages are present.
The errors can be divided into two groups:

- flag errors
- hardware errors

7.1.1 FLAG ERRORS

The flag errors are printed behind the result of a certain test. An explanation of the flag is given in the EVALUATE SAMPLES menu. The following flag errors can occur:

- ♦ GENERAL HARDWARE ERROR
- ♦ INSUFFICIENT REAGENT
- ♦ INSUFFICIENT SAMPLE
- ♦ LAMP UNDERRANGE
- ♦ LAMP OVERRANGE
- ♦ LAMP REF CHANNEL UNDERRANGE
- ♦ LAMP REF CHANNEL OVERRANGE
- ♦ MEAS. UNDERRANGE
- ♦ MEAS. OVERRANGE
- ♦ MEAS. REF UNDERRANGE
- ♦ MEAS. REF OVERRANGE
- ♦ CUVET TEMPERATURE ERROR
  RERUN
  LINEARITY ERROR
  ABSORBANCE LIMIT ERROR
  REAGENT ABSORBANCE DEVIATION ERROR
  REAGENT BLANK LIMIT ERROR
  CALIBRATION LIMIT ERROR
- ♦ CONTROL LIMIT ERROR
  REFERENCE LIMIT ERROR
  REAGENT ABORBANCE ERROR

The errors marked with (♦) are also displayed on the screen in a window, and can be recognised by an audible alarm (repeating four short beeps).
Pressing any key can stop the audio alarm.
These errors are normally caused by a hardware error and are explained hereafter.
The other errors are normally caused by an another error (programming or chemical error) and are explained in the instruction manual.

GENERAL HARDWARE ERROR

This error will be displayed when one of the hardware errors (mentioned in the next section) has occurred and the user ignores this error. The best way to find this error is to make a printout of the error history of the instrument.

INSUFFICIENT REAGENT

This error will be displayed when the safety switch of the reagent needle is activated (bottle empty), or when liquid detection of the reagent needle is not detecting any liquid (no bottle present). This error can also occur when the liquid detection is not working.

INSUFFICIENT SAMPLE

This error will be displayed when the safety switch of the sample needle is activated (sample cup empty), or when liquid detection of the sample needle is not detecting any liquid after aspirating the sample (detection of air bubble).

LAMP ERRORS

	Reference detector	Cuvette detector
100 mV signal > 21.000 counts	Lamp ref underrange	Meas ref underrange
100 mV signal < 19.000 counts	Lamp ref overrange	Meas ref overrange
Lamp signal > 29.000 counts	Lamp underrange	Meas underrange
Lamp signal < 10 counts	Lamp overrange	Meas overrange

7.1.2 HARDWARE ERRORS

These errors are displayed on the screen in a window, and can be recognised by an audio alarm (continuous beeps at three different pitches).
Pressing the space bar can stop the audio alarm.

Here is a list of all the hardware errors:

E00	Z80 MASTER CARD RAM CHECK ERROR
E01	Z80 MASTER CARD ROM CHECK ERROR
E02	SYSTEM EMERGENCY HALT
W03	CYCLE TIMING PROBLEM
E05	NO CLEAN CUVETTE
E07	SYSTEM RESET INCOMPLETE
E10	NO VACUUM
E11	WASTE FULL
E12	WATER RUNNING OUT
E13	LAMP FAILURE
E14	CUVETTES TEMP ERROR
E15	REAGENT NEEDLE TEMP ERROR
E16	CONCENTRATED WASTE FULL
E17	INSUFFICIENT WATER
E20	SAMPLE SYR. POS. ERROR
E21	SAMPLE SYR. POS. ERROR

E22	SAMPLE VALVE ERROR
E23	REAG. SYR. POS. ERROR
E24	REAG. SYR. POS. ERROR
E25	REAG. VALVE ERROR
E30	PIPETTOR 14V FAILED
E31	PIPETTOR 30V FAILED
E32	PIPETTOR INIT FAILED
E35	SAMPLE SYR RESET FAILED
E36	REAGENT SYR RESET FAILED
E37	PIPETTOR COMMUNICATION ERROR
E40	MEAS.DISC 14V FAILED
E41	MEAS.DISC 30V FAILED
E42	MEASUREMENT DISC ERROR
E43	FILTER ERROR
E52	MEAS.DISC INIT FAILED
E55	MEAS. DISC RESET FAILED
E56	FILTER RESET FAILED
E57	MEAS. DISC COMMUNICATION ERROR
E60	SAMPLE ARM 14V FAILED
E61	SAMPLE ARM 30V FAILED
E62	SAMPLE ARM HORIZONTAL ERROR
E63	SAMPLE ARM VERTICAL ERROR
E72	SAMPLE ARM INIT FAILED
E75	SAMPLE ARM RESET FAILED
E76	SAMPLE ARM RESET FAILED
E77	SAMPLE ARM COMMUNICATION ERROR
E80	REAGENT ARM 14V FAILED
E81	REAGENT ARM 30V FAILED
E82	REAGENT ARM HORIZONTAL ERROR
E83	REAGENT ARM VERTICAL ERROR
E92	REAGENT ARM INIT FAILED
E95	REAGENT ARM RESET FAILED
E96	REAGENT ARM RESET FAILED
E97	REAGENT ARM COMMUNICATION ERROR
E100	DISCS 14V FAILED
E101	DISCS 30V FAILED
E102	REAGENT DISC ERROR
E103	SAMPLE DISC ERROR
E112	DISCS INIT FAILED
E115	REAGENT DISC RESET FAILED
E116	SAMPLE DISC RESET FAILED
E117	REAG./SAMP. DISCS COMMUN. ERROR
E120	WASHARM/BELLOWS PUMP 14V FAILED
E121	WASHARM/BELLOWS PUMP 30V FAILED
E122	WASHARM ERROR
E123	BELLOWS PUMP ERROR
E124	WATER OVERFLOW MEASUREMENT DISC
E125	NO CUVETTES
E132	WASHARM/BELLOWS PUMP INIT FAILED
E135	WASHARM RESET FAILED
E136	BELLOWS PUMP RESET FAILED
E137	WASHARM/BELLOWS PUMP COMM.ERROR

E140	ISE NOT PRESENT
W141	ISE SYNCHRONISATION ERROR
E142	ISE COMMUNICATION ERROR
W143	ISE RESET ACTIVE
E144	ISE ARM ERROR
E145	ISE NOT READY
E146	ISE STANDARD A NOT DETECTED
E147	ISE STANDARD B NOT DETECTED
E150	ISE CHECK TEMPERATURE
E151	ISE NOT CALIBRATED
E152	ISE SAMPLE DETECTION ERROR
E153	ISE SAMPLE DETECTION ERROR
E154	ISE VALVES ERROR
E155	ISE ELECTRODES OR FLUIDS ERROR
E156	ISE INSUF. CLEANER OR CONDIT
E157	ISE POWER FAIL
E160	Z80 MASTER CARD RS-232 ERROR TOO MUCH ETRANSMISSIONS TO z80
E161	Z80 MASTER CARD RS-232 ERROR TOO MUCH DOUBLE ACKS SENT TO z80
E162	Z80 MASTER CARD RS-232 ERROR CTS TOO LONG INACTIVE
E163	Z80 MASTER CARD RS-232 ERROR CTS TOO LONG ACTIVE
E164	MEMORY CHECKSUM CORRUPTED
E165	MEMORY CHANGED
E166	WATCHDOG EXPECTED IN 5 SECONDS

7.1.3 Z80 ERRORS

E00 Z80 MASTER CARD RAM CHECK ERROR

Cause: One or more bits are not readable / writable.

E01 Z80 MASTER CARD ROM CHECK ERROR

Cause: Checksum is not equal to zero.
The cause of this error is most likely that the RAM or ROM on the system board are malfunctioning.

Solution: Replace RAM and/or ROM of the System board (slot 1).

E02 SYSTEM EMERGENCY HALT

Cause: During rotation of the measurement rotor is detected that either the ISE arm, the reagent arm, the sample arm or the wash arm is not at the high position. (Probably touched). The detection for the ISE arm and the wash arm is done by an opto-coupler.

Solution: Check wash arm opto 0
If occurs together with E144, ISE arm error, see E144

E05 NO CLEAN CUVETTE

Cause: When according to the instrument there is no empty, clean cuvette.
The bellows pump has stopped, there was a system reset and the cuvettes were not emptied yet.

Solution: Take out the cuvette rotor. Empty and clean the cuvette rotor.
Reset the system and continue the measurements.

E07 SYSTEM RESET INCOMPLETE

Cause: When the system reset is not completed properly.
This error is always in combination with one or more other errors.

Solution: Solve other errors and reset the system.

E10 NO VACUUM

Cause: Vacuum is below 0.4 bar for a period longer than 2.5 seconds.

Solution: Check the vacuum pump and membranes.
Check Valve board in pump unit.
Check the vacuum tubing for leakage and clamping.
Check the valves on leakage
Check and adjust if necessary the vacuum sensor.

E11 / E16 WASTE FULL / CONCENTRATED WASTE FULL

Cause: When the WASTE FULL signal is “high” for at least 1 second.
Solution: Check the floating switches (reed relays)
Check the Valve board in the pump unit
Check all the wiring
Replace KIO on the system board
Replace system board

E12 WATER RUNNING OUT

Cause: When the highest float switch in the water cask is not detecting water for more than 25 seconds.
Solution: Check the water in the water container
Make sure the pump is pumping water by holding the pump unit and the water container at a higher level for a short while.
Check the water filter
Check level switches (reed relays)
Check if the water tubing is leaking or blocked
If signal is O.K on PL7 of system board replace KIO

E13 LAMP FAILURE

Cause: When during a measurement a counter overrange signal is detected. The signal counter overrange signal is generated when the photocell signal is too low.
Solution: Check lamp adjustment and replace lamp if necessary.
Check if the lamp voltage is present and well adjusted.
Check if the right filter is selected
When also the blank data values are not correct the problem can be caused by a wrong gain setting of the input amplifier or a defective input amplifier (on the Photometer Board).
Check the photometer board adjustment.
Replace photometer board.

E14 CUVETTES TEMP ERROR

Cause: When the temperature control circuit is reporting the 'temperature not OK' signal for 5 minutes. The circuit will be switched off to prevent hazardous situations (cuvet therm control signal, pin 5 PL7).

Solution: Check 'Cuvet Temp OK' signal on A5, PL7, pin 4 (hoog = O.K.)
Check the resistance of the Peltier elements (A5, PL2, Pin 3-4, 2 to 10 ohms)
Check the temperature sensor (thermistor) in the cuvette block (A5, PL5, Pin 1-3, 36KOhms at room temperature)
Check fuses and voltages on temperature board
Exchange A5, Temperature board (check that the switch is in the 'on' position!)
For repairs; check the 'Powerbox' +15V (tab8) and
15V (tab7) generator.

E15 REAGENT NEEDLE TEMP ERROR

Cause: When the temperature control circuit is reporting the 'temp. not OK' signal for 2.5 minutes. The circuit will be switched off to avoid overheating of the reagent needle.

Solution: Check temperature sensor (NTC) of the needle (red and blue wires in the arm): 25KOhms
Check heating element of the needle (purple wires): 50 Ohms
Check wiring to the Temperature board
Exchange temperature board
For repairs; check the 'Powerbox' +15V (tab8) and
15V (tab7) generator.

E16 CONCENTRATED WASTE FULL see E11; Waste Full

E17 INSUFFICIENT WATER

Cause: This error will be generated when the lowest float switch in the water cask is not detecting water. This error must be preceded by a 'WATER RUNNING OUT' error.

Solution: See E12, WATER RUNNING OUT

7.1.4 PIPETTOR ERRORS

E20/21 SAMPLE SYR. POS. ERROR

Cause: When the syringe is going down and detects down opto or when syringe is going up and detects reset opto not in accordance with current co-ordinate. This can have a mechanical cause, bad functioning of the opto switches or stepper motor.

Note that the upper opto switch is the 'DOWN OPTO' and the lower opto switch is the 'RESET OPTO'.

Solution: Check if the syringe motors are operating by means of the service menu.
Check if the timing belts of the two syringe motors are adjusted well (not too loose or too tight), and if the spindle is moving smoothly.
Clean, grease and adjust the spindle if necessary.
Check opto switches

E22 SAMPLE VALVE ERROR

Cause: When the opto reading is not in accordance with the current theoretical position.

Solution: Check the opto switches of the valves
Check the DC motor. The resistance of older motors can get low, causing the multifuse on the Motion Control Board to act.
Check the dispenser driver board

E23/24 REAGENT SYRINGE POSITIONING ERROR (see E21 / E22)

E25 REAG. VALVE ERROR (see E22)

E30 PIPETTOR 14V FAILED

Cause: This error will be generated when the circuit (see sec 8 of this manual, motion control board sheet ¼ diode D25) does not detect the correct voltage.

Solution: Check the fuses and voltage on the motion control board.
Check connectors PL3 and PL4.
Check if all voltages are present on the power supply, and repair or exchange if necessary.

E31 PIPETTOR 30V FAILED

Cause: This error will be generated when the circuit (see sec 8 of this manual, motion control board sheet ¼ diode D26) does not detect the correct voltage.

Solution: Check the fuses and voltage on the motion control board.
Check connectors PL3 and PL4.
Check if all voltages are present on the power supply, and repair or exchange if necessary.
Check pipettor stepper motors.

E35 SAMPLE SYR. RESET FAILED

Cause: This error will be generated when the motion control board does not report the sample syringe reset after the reset command.

Solution: Check if the communication between the system board and motion control board is present. When there is no communication this can either be causer by: the SIO on the system board, the KIO on the motion control board or the PCB fuses (on the motion control board). Replace the board(s) or replace the defective components.

E36 REAGENT SYR. RESET FAILED

Cause: This error will be generated when the motion control board does not report the reagent syringe reset after the reset command.

Solution: Check if the communication between the system board and motion control board is present. When there is no communication this can either be causer by: the SIO on the system board, the KIO on the motion control board or the PCB fuses (on the motion control board). Replace the board(s) or replace the defective components.

E37 PIPETTOR COMMUNICATION ERROR

Cause: This error will be generated when the communication to the motion control board for the pipettors stalls or if an unknown character is “echoed”. Normally this error will occur when the communication is disrupted or distorted.

Solution: Check if the communication between system board and motion control board is present. When there is no communication this can either be caused by: the wiring, the SIO on the system board, the KIO on the motion control board or the main PCB fuse (on the motion control board). Replace the board(s) or replace the defective components.

7.1.5 MEASUREMENT DISC / FILTER WHEEL ERRORS

E40 MEAS. DISC 14V FAILED

Cause: This error will be generated when the circuit (see sec 8 of this manual, motion control board sheet ¼ diode D25) does not detect the correct voltage.

Solution: Check the fuses and voltage on the motion control board.
Check connectors PL3 and PL4.
Check if all voltages are present on the power supply, and repair or exchange if necessary.

E41 MEAS. DISC 30V FAILED

Cause: This error will be generated when the circuit (see sec 8 of this manual, motion control board sheet ¼ diode D26) does not detect the correct voltage.

Solution: Check the fuses and voltage on the motion control board.
Check connectors PL3 and PL4.
Check if all voltages are present on the power supply, and repair or exchange if necessary.
Check measuring rotor stepper motor and filter wheel stepper motor.

E42 MEASUREMENT DISC ERROR

Cause: This error will be generated when:

- the reset position is detected but according to the software this is not possible
- the direction encoders do not detect any movement of the disc
- the direction encoders detect a movement which is not in accordance with the software co-ordinates

This can either be caused by loss of steps because of a mechanical malfunctioning (friction, blocking), or electrical malfunctioning (opto, wiring, control circuit)

Solution: Check if the measuring disc is moving smoothly and if there is any blockage.
Also check if the timing belt of the stepper motor is adjusted well (not too loose or too tight). Repair or adjust if necessary.
Check if the opto-couplers are working, and repair if necessary.
When there is no communication at all, exchange the PIO on the motion control board for the measuring disc.

E43 FILTER ERROR

Cause: This error will be generated when the reset position is detected but according to the software this is not possible. This can either be caused by loss of steps because of a mechanical malfunctioning (friction, blocking), or electrical malfunctioning (opto, wiring, control circuit).

Solution: Check if the filter wheel is moving smoothly and if there is any blockage. Repair or adjust if necessary.
Check if the opto-coupler is working, and repair if necessary.
When there is no communication at all, exchange the PIO on the motion control board for the filter wheel.

E52 MEAS. DISC INIT FAILED; see E55

E55 MEAS. DISC RESET FAILED

Cause: This error will be generated when the measuring disc motion control did not report the correct disc position within 8 seconds after the reset command.

Solution: Check if the communication between system board and motion control board is present. When there is no communication this can either be caused by: the wiring, the SIO on the system board, the KIO on the motion control board or the main PCB fuse (on the motion control board). Replace the board(s) or replace the defective components.
Check if there is a mechanical obstruction of the measuring disc, and repair if necessary.

E56 FILTER RESET FAILED

Cause: This error will be generated when the filter wheel motion control board did not report the correct filter reset position within 8 seconds after the reset command.

Solution: Check if the communication between system board and motion control board is present. When there is no communication this can either be caused by: the wiring, the SIO on the system board, the KIO on the motion control board or the main PCB fuse (on the motion control board). Replace the board(s) or replace the defective components.
Check if there is a mechanical obstruction of the filter wheel, and repair if necessary.

E57 MEAS. DISC COMMUNICATION ERROR

Cause: This error will be generated when the communication to motion control board for the measuring disc stalls or if an unknown character is “echoed”. Normally this error will occur when the communication is disrupted or distorted.

Solution: Check if the communication between system board and motion control board is present. When there is no communication this can either be caused by: the wiring, the SIO on the system board, the KIO on the motion control board or the main PCB fuse (on the motion control board). Replace the board(s) or replace the defective components.

7.1.6 SAMPLE ARM ERRORS

E60 SAMPLE ARM 14V FAILED

Cause: This error will be generated when the circuit (see sec 8 of this manual, motion control board sheet ¼ diode D25) does not detect the correct voltage.

Solution: Check the fuses and voltage on the motion control board. Check connectors PL3 and PL4. Check if all voltages are present on the power supply, and repair or exchange if necessary.

E61 SAMPLE ARM 30V FAILED

Cause: This error will be generated when the circuit (see sec 8 of this manual, motion control board sheet ¼ diode D26) does not detect the correct voltage.

Solution: Check the fuses and voltage on the motion control board.
Check connectors PL3 and PL4.
Check if all voltages are present on the power supply, and repair or exchange if necessary.
Check sample arm stepper motors.

E62 SAMPLE ARM HORIZONTAL ERROR

Cause: This error occurs when the opto reading of the horizontal movement of the sample arm is not in accordance with the current theoretical position. This normally happens when the sample arm is obstructed by something or when the safety switch (inside the sample needle) is activated.

Solution: Perform a selective reset of the sample arm. Check when this error is occurring frequently the operation of the sample needle switch, and clean if necessary the contacts of the switch (only systems with mechanical needle switch). Check the operation of the opto-couplers and replace if necessary.

E63 SAMPLE ARM VERTICAL ERROR

Cause: This error occurs when the opto reading of the vertical movement of the sample arm is not in accordance with the current theoretical position. This normally happens when the sample arm is obstructed by something or when the safety switch (inside the sample needle) is activated.

Solution: Perform a selective reset of the sample arm.
Check when this error is occurring frequently the operation of the sample needle switch, and clean if necessary the contacts of the switch (only mechanical needle switch).
Check the operation of the opto-couplers and replace if necessary.

E72 SAMPLE ARM INIT FAILED; see E75

E75 SAMPLE ARM HORIZ. RESET FAILED

Cause: This error will be generated when the motion control board does not report the horizontal reset position after the reset command.

Solution: Check if the communication between system board and motion control board is present. When there is no communication this can either be caused by: the wiring, the SIO on the system board, the KIO on the motion control board or the main PCB fuse (on the motion control board). Replace the board(s) or replace the defective components. Check if there is a mechanical obstruction of the sample arm, and repair if necessary. Check if the opto-couplers are working correctly, and repair if necessary.

E76 SAMPLE ARM VERTICAL RESET FAILED

Cause: This error will be generated when the motion control board does not report the vertical reset position after the reset command.

Solution: Check if the communication between system board and motion control board is present. When there is no communication this can either be caused by: the wiring, the SIO on the system board, the KIO on the motion control board or the main PCB fuse (on the motion control board). Replace the board(s) or replace the defective components. Check if there is a mechanical obstruction of the sample arm, and repair if necessary. Check if the opto-couplers are working correctly, and repair if necessary.

E77 SAMPLE ARM COMMUNICATION ERROR

Cause: This error will be generated when the communication to motion control board for the sample arm stalls or if an unknown character is “echoed”. Normally this error will occur when the communication is disrupted or distorted.

Solution: Check if the communication between system board and motion control board is present. When there is no communication this can either be caused by: the wiring, the SIO on the system board, the KIO on the motion control board or the main PCB fuse (on the motion control board). Replace the board(s) or replace the defective components.

7.1.7 REAGENT ARM ERRORS

E80 REAGENT ARM 14V FAILED

Cause: This error will be generated when the circuit (see sec 8 of this manual, motion control board sheet ¼ diode D25) does not detect the correct voltage.

Solution: Check the fuses and voltage on the motion control board. Check connectors PL3 and PL4. Check if all voltages are present on the power supply, and repair or exchange if necessary.

E81 REAGENT ARM 30V FAILED

Cause: This error will be generated when the circuit (see sec 8 of this manual, motion control board sheet ¼ diode D26) does not detect the correct voltage.

Solution: Check the fuses and voltage on the motion control board. Check connector PL3 and PL4. Check if all voltages are present on the power supply, and repair or exchange if necessary. Check reagent arm stepper motors.

E82 REAGENT ARM HORIZONTAL ERROR

Cause: This error occurs when the opto reading of the horizontal movement of the reagent arm is not in accordance with the current theoretical position. This happens normally when the reagent arm is obstructed by something or when the safety switch (inside the reagent needle) is activated.

Solution: Perform a selective reset of the reagent arm.
Check when this error is occurring frequently the operation of the reagent needle switch, and clean if necessary the contacts of the switch (only mechanical safety switch).
Check the operation of the opto-couplers, and replace if necessary.

E83 REAGENT ARM VERTICAL ERROR

Cause: This error occurs when the opto reading of the vertical movement of the reagent arm is not in accordance with the current theoretical position. This happens normally when the reagent arm is obstructed by something or when the safety switch (inside the reagent needle) is activated.

Solution: Perform a selective reset of the reagent arm. Check when this error is occurring frequently the operation of the reagent needle switch, and clean if necessary the contacts of the switch (only mechanical safety switch). Check the operation of the opto-couplers, and replace if necessary.

E92 REAGENT ARM INIT FAILED; see E95

E95 REAGENT ARM HORIZ. RESET FAILED

Cause: This error will be generated when the motion control board does not report the horizontal reset position after the reset command.

Solution: Check if the communication between system board and motion control board is present. When there is no communication this can either be caused by: the wiring, the SIO on the system board, the KIO on the motion control board or the main PCB fuse (on the motion control board). Replace the board(s) or replace the defective components. Check if there is a mechanical obstruction of the reagent arm, and repair if necessary. Check if the opto-couplers are working correctly, and repair if necessary.

E96 REAGENT ARM VERTICAL RESET FAILED

Cause: This error will be generated when the motion control board does not report the vertical reset position after the reset command.

Solution: Check if the communication between system board and motion control board is present. When there is no communication this can either be caused by: the wiring, the SIO on the system board, the KIO on the motion control board or the main PCB fuse (on the motion control board). Replace the board(s) or replace the defective components. Check if there is a mechanical obstruction of the reagent arm, and repair if necessary. Check if the opto-couplers are working correctly, and repair if necessary.

E97 REAGENT ARM COMMUNICATION ERROR

Cause: This error will be generated when the communication to motion control board for the reagent arm stalls or if an unknown character is echoed. Normally this error will occur when the communication is disrupted or distorted.

Solution: Check if the communication between system board and motion control board is present. When there is no communication this can either be caused by: the wiring, the SIO on the system board, the KIO on the motion control board or the main PCB fuse (on the motion control board). Replace the board(s) or replace the defective components.

7.1.8 REAGENT / SAMPLE DISC ERRORS

E100 DISCS 14V FAILED

Cause: This error will be generated when the circuit (see sec 8 of this manual, motion control board sheet ¼ diode D25) does not detect the correct voltage.

Solution: Check the fuses and voltage on the motion control board. Check connectors PL3 and PL4. Check if all voltages are present on the power supply, and repair or exchange if necessary.

E101 DISCS 30V FAILED

Cause: This error will be generated when the circuit (see sec 8 of this manual, motion control board sheet ¼ diode D26) does not detect the correct voltage.

Solution: Check the fuses and voltage on the motion control board. Check connectors PL3 and PL4. Check if all voltages are present on the power supply, and repair or exchange if necessary. Check sample rotor and reagent rotor stepper motors.

E102 REAGENT DISC ERROR

Cause: This error occurs when the opto reading of the reagent disc is not in accordance with the current theoretical position. This happens normally when the disc is obstructed by something and the stepper motor is loosing steps.

Solution: Perform a selective reset of the reagent disc. Check the operation of the opto-couplers, and replace if necessary. Check if the V-sealing is sufficient greased and grease if necessary.

E103 SAMPLE DISC ERROR

Cause: This error occurs when the opto reading of the sample disc is not in accordance with the current theoretical position. This happens normally when the disc is obstructed by something.

Solution: Perform a selective reset of the sample disc. Check the operation of the opto-couplers, and replace if necessary.

E112 DISCS INIT FAILED; see E115, E116

E115 REAGENT DISC RESET FAILED

Cause: This error will be generated when the motion control board does not report the reset position of the reagent disc after the reset command.

Solution: Check if the communication between system board and motion control board is present. When there is no communication this can either be caused by: the wiring, the SIO on the system board, the KIO on the motion control board or the main PCB fuse (on the motion control board). Replace the board(s) or replace the defective components. Check if there is a mechanical obstruction of the reagent disc, and repair if necessary. Check if the opto-couplers are working correctly, and repair if necessary.

E116 SAMPLE DISC RESET FAILED

Cause: This error will be generated when the motion control board does not report the reset position of the sample disc after the reset command.

Solution: Check if the communication between system board and motion control board is present. When there is no communication this can either be caused by: the wiring, the SIO on the system board, the KIO on the motion control board or the main PCB fuse (on the motion control board). Replace the board(s) or replace the defective components. Check if there is a mechanical obstruction of the sample disc, and repair if necessary. Check if the opto-couplers are working correctly, and repair if necessary.

E117 REAG/SAMP DISCS COMMUNICATION ERR.

Cause: This error will be generated when the communication to motion control board for the reagent or sample disc stalls or if an unknown character is “echoed”. Normally this error will occur when the communication is disrupted or distorted.

Solution: Check if the communication between system board and motion control board is present. When there is no communication this can either be caused by: the wiring, the SIO on the system board, the KIO on the motion control board or the main PCB fuse (on the motion control board). Replace the board(s) or replace the defective components.

7.1.9 WASH ARM ERRORS

E120 WASHARM/BELLOWS PUMP 14V FAILED

Cause: This error will be generated when the circuit (see sec 8 of this manual, motion control board sheet ¼ diode D25) does not detect the correct voltage.

Solution: Check the fuses and voltage on the motion control board.
Check connectors PL3 and PL4. Check if all voltages are present on the power supply, and repair or exchange if necessary.

E121 WASHARM/BELLOWS PUMP 30V FAILED

Cause: This error will be generated when the circuit (see sec 8 of this manual, motion control board sheet ¼ diode D26) does not detect the correct voltage.

Solution: Check the fuses and voltage on the motion control board.
Check connector PL3 and Pl4. Check if all voltages are present on the power supply, and repair or exchange if necessary.
Check wash unit stepper motor and bellows pump stepper motor.

E122 WASH ARM ERROR

Cause: This error will be generated when the opto reading is not in accordance with calculated software position. The cause can be that the motor is not operating due to mechanical obstruction, electrical malfunctioning, bad connection or because of malfunctioning of the opto's.

Solution: Check if the washarm is fixed properly.
Check if the wash arm can move smoothly, and repair if necessary.
Check if the electrical connections are correct, and repair if necessary.
Check if the opto-coupler functions are working and repair if necessary.

E123 BELLOWS PUMP ERROR

Cause: This error will be generated when the opto reading is not in accordance with calculated software position. The cause can be that the motor is not operating due to mechanical obstruction, electrical malfunctioning, bad connection or because of malfunctioning of the opto's.

Note that this error can also be generated when a cuvette error occurs. Usually the error disappears when the cuvette error has been solved.

Solution: Check if the pump can move smoothly, and repair if necessary.
Check if the electrical connections are correct, and repair if necessary.
Check the opto-coupler functions are working and repair if necessary.

E124 WATER OVERFLOW MEASUREMENT DISC

Cause: This error will be generated when the overflow contact signal detects a low impedance to ground (water level in the cuvette rotor is too high). The overflow of the cuvette rotor can be caused by not sufficient vacuum, badly adjusted wash arm (needle against bottom cuvette rotor) or an electrical short circuit of the detection wire to frame.

Solution: Check visually if there is really a water overflow (can also be caused by bubbles). If this is the case clean the washarm and check the vacuum and the valves (V2, V4 and V14).
If there is no real water overflow clean the underside of the washarm. For older washarms the resistance of the isolator can become too low; replace washarm.

E125 NO CUVETTES

Cause: This error will be generated when at resetting the wash arm can reach a too low position according to the opto read-out.

Solution: Check if a cuvette rotor is present, and place one if necessary.
Check if the washarm is fixed properly, and fix if necessary.
Check if the wash arm adjustment is according the procedure given in section 5.3 of this manual.
Check if the opto-couplers are malfunctioning, and repair if necessary.

E135 WASH ARM RESET FAILED

Cause: This error will be generated when the wash arm motion control board does not report the correct wash arm position within 5 seconds after the reset command.

Solution: Check if the communication between system board and motion control board is present. When there is no communication this can either be caused by: the wiring, the SIO on the system board, the KIO on the motion control board or the main PCB fuse (on the motion control board). Replace the board(s) or replace the defective components.
Check if there is a mechanical obstruction of the wash arm, and repair if necessary. Check if the opto-couplers are working correctly, and repair if necessary.

E136 BELLOWS PUMP RESET FAILED

Cause: This error will be generated when the motion control board does not report the correct bellow position within 25 seconds after the reset command.

Solution: Check if the communication between system board and motion control board is present. When there is no communication this can either be caused by: the wiring, the SIO on the system board, the KIO on the motion control board or the main PCB fuse (on the motion control board). Replace the board(s) or replace the defective components. Check if there is a mechanical obstruction of the bellow pump, and repair if necessary. Check if the opto-couplers are working correctly, and repair if necessary.

E137 WASHARM/BELLOWS PUMP COMM.ERROR

Cause: This error will be generated when the communication to motion control board for the washarm/bellows pump stalls or if an unknown character is “echoed”. Normally this error will occur when the communication is disrupted or distorted.

Solution: Check if the communication between system board and motion control board is present. When there is no communication this can either be caused by: the wiring, the SIO on the system board, the KIO on the motion control board or the main PCB fuse (on the motion control board). Replace the board(s) or replace the defective components.

7.1.10 ISE ERRORS

E140 ISE NOT PRESENT

Cause: This error will be generated when the instrument detects that the ISE unit is not (well) connected.
A signal has been send to the ISE and no return signal is detected.

Solution: Check is the communication cable is connected properly and if the ISE unit is switched on.

E141 ISE SYNCHRONISATION ERROR

Cause: A request is sent and the “ISE busy” signal is active.

Solution: Check communication between ISE and analyser (cable connections, switched on, fuses (F3 or F4) on SBC card of ISE).

E142 ISE COMMUNICATION ERROR

Cause: Failure detected in communication between analyser and ISE.

Solution: See E141

W143 ISE RESET ACTIVE

Cause: This error will occur in combination with E140 when there is no communication with the ISE.
Solution: See E140.

E144 ISE ARM ERROR

Cause: This error will be generated when the ISE arm is in the lower position when its not allowed (probably touched by hand).
Solution: Press Check Again and continue.

E145 ISE NOT READY

Cause: This error will be generated when the ISE is executing a command and another command is sent, or when the ISE is in the warming-up procedure.
Solution: Press Check Again and continue.

E146 ISE STANDARD A NOT DETECTED

Cause: This error will occur when during calibration the liquid is not detected within in certain window.
Solution: See 7.2 of ISE service manual (STANDARD A/B NOT DETECTED).

E147 ISE STANDARD B NOT DETECTED

Cause: This error will occur when during calibration the liquid is not detected within in certain window.
Solution: See section 7.2 of ISE service manual (STANDARD A/B NOT DETECTED.

E150 ISE CHECK TEMPERATURE

Cause: The temperature is outside its limits (+10°C.... +50°C).
Solution: See section 7.2 of ISE service manual (CHECK TEMPERATURE).

E151 ISE NOT CALIBRATED

Cause: This error occurs when the ISE detects that the calibration is not correct, or when the cover was open for a longer period of time.
Solution: Perform a new calibration.

E152 ISE SAMPLE DETECTION ERROR

Cause: This error will occur when no sample is detected at the wrong moment.
Solution: See section 7.2 of ISE service manual (NO SAMPLE).

E153 ISE SAMPLE DETECTION ERROR

Cause: This error will occur when sample is detected at the wrong moment.
Solution: See section 7.2 of ISE service manual (SAMPLE DETECTION).

E154 ISE VALVES ERROR

Cause: This error will a occur when one of the valves is not working correctly.
Solution: See section 7.2 of ISE service manual (CHECK VALVES).

E155 ISE ELECTRODES OR FLUIDS ERROR

Cause: This error will occur after a calibration when one or more electrodes cannot be calibrated.
Solution: See section 7.2 of ISE service manual (CHECK ELECTRODES or NA, K, CL NOT CALIBRATED).

E157 ISE POWER FAIL

Cause: A power fail of shorter then 30 seconds is detected.
Solution: Check the power and continue measurements.

7.1.11 PC-ERRORS

E160 Z80 MASTER CARD RS-232 ERROR

Cause: This error will be generated when there are too much retransmissions (more than 12) of a message sent by the PC to the system board. If a message sent by the PC to the system board is not acknowledged by the Z80 within 5 seconds, it is retransmitted.
Solution: Communication line is not ok, or Z80 main board is not ok. Replace the board or replace the defective components. Check the wiring.

E161 Z80 MASTER CARD RS-232 ERROR

Cause: This error will be generated if a message (from system board to PC) is not acknowledged by the PC (according to the system board) or the Z80 does not receive the acknowledge, the message is sent again to the PC.If this happens 12 times for the same message, this error is displayed.
Solution: The communication line is not ok. (see E160)

E162 Z80 MASTER CARD RS-232 ERROR

Cause: This error will be generated if the handshake line (RTS) of the system board is too long inactive (more than 60 seconds) because the PC is not cleared to sent a message to the Z80.
Solution: Communication line is not ok, or system board is not ok. Replace the board or replace the defective components, or replace wiring.

E166 WATCHDOG EXPECTED IN 5 SECONDS

Cause: This error will be generated when the software is crashed or there is a hardware problem, and the program is stucked. After one minute the

watchdog goes off and restarts the system. It will continue where it stopped.

Solution: The error can be found in the error history.

7.2 TROUBLE SHOOTING

7.2.1 INTRODUCTION

The system trouble shooting information in this section provides a means of isolating faults, possible causes and remedies.

Note that the information in this section does not provide an overall step-by-step trouble shooting guide, but merely is intended to supply the general guide lines on how to proceed in cases of a failure and in addition some symptoms, probable causes and remedies are provided.

Being an experienced service engineer you will appreciate that considerable part of problems with instruments in general result from external causes.
Environment problems like heavy line voltage fluctuations (peaks etc.), inadequate earth ground connections, dust especially in combination with high ambient humidity, corrosive vapours (acid), dirt etc. can all affect the performance of an instrument.

For sensitive photometric equipment, high intensity light (direct sunlight or from artificial sources) might affect the operation as well. In addition extreme high or low ambient temperatures will adversely effect these instruments.
As for everything, prevention is far better than repair; therefore we strongly advise to follow the preventive maintenance instructions closely.
Finally, the customer maintenance will be of utmost importance as well. It is very important that the cleaning instructions for the fluid system as described in the Instruction Manual are followed closely.

7.2.2 LIST OF PROBABLE FAILURES

7.2.2.1 Inconsistent measuring results

Inconsistent measuring results can be defined as follows: drop-outs and too low measuring results.

7.2.2.2 Drop outs

Symptom:	Occasional drop-outs in the measurement values; too high or too low.
Probable cause:	Remaining water in the cuvette rotor, because the wash arm is not emptying sufficiently.
Solution:	Check the adjustment of the wash arm (the distance between the needle unit in the down position and the cuvette bottom must be 0.5mm) if this is according the procedure given in section 5.3. Check the functioning of valve V2 and V4.

7.2.2.3 Low measuring values

Symptom: The values of the controls are too low.
Probable cause: The temperature of the cuvette rotor is too low.
Solution: Check the temperature of the cuvette rotor by following the adjustment procedure of section 6.5.

Blank error:

Symptom: The SD value of the cuvette blank is higher then 0.0150.
Probable cause: The rotor is damaged or polluted.
Solution: Replace the rotor by a new one and perform a new blank procedure.
Probable cause: When the reagent needle is dispensing water which contains air bubbles the cuvette rotor, caused by leakage of the liquid system or leakage, the teflon syringe tips or syringe valve.
Solution: Check the tubing on leakage.
Check the condition of the teflon tips and valve and replace if necessary.

7.2.3 General trouble shooting

7.2.3.1 The instrument does not start-up

Check the fuses in the mains cable connection
Open slot A2 and check the power supply voltages with respect to tab6:
- tab 2: 5.1 V
- tab 8: 14 V
- tab 1: 30 V

The 12 V has no connection to this board, but the fans run on 12V.

7.2.3.2 Communication check system board <> motion control boards

If a reset fails (see paragraph 3.11 for the power-on sequence) the instrument will stop the reset procedure and will generate an error for the part that fails but probably also for parts that have not been reset yet.

If the reset fails one can check if this is caused by a failing communication between the system board and the motion control boards in the following way:

- select INSTALLATION MENU
- select RELEASE and press <Enter>

The system board now communicates with the motion control boards that send back the version of the EPROM they contain. If this communication fails (retry a few times!) you might try to replace the KIO that usually is responsible for this failure.

If the communication suddenly fails during normal operation the instrument generates error Exxx COMMUNICATION ERROR.

7.2.3.3 Motion Control Board exchanges

As all motion control boards are the same you can exchange two boards in order to know if a problem is caused by the board or by something else.

The EPROMs determine the function of the board and they must stay with the slot! Note that if you exchange board A6 (measurement rotor) that you copy the position of the hexacode switch from this board to the new board on this position.

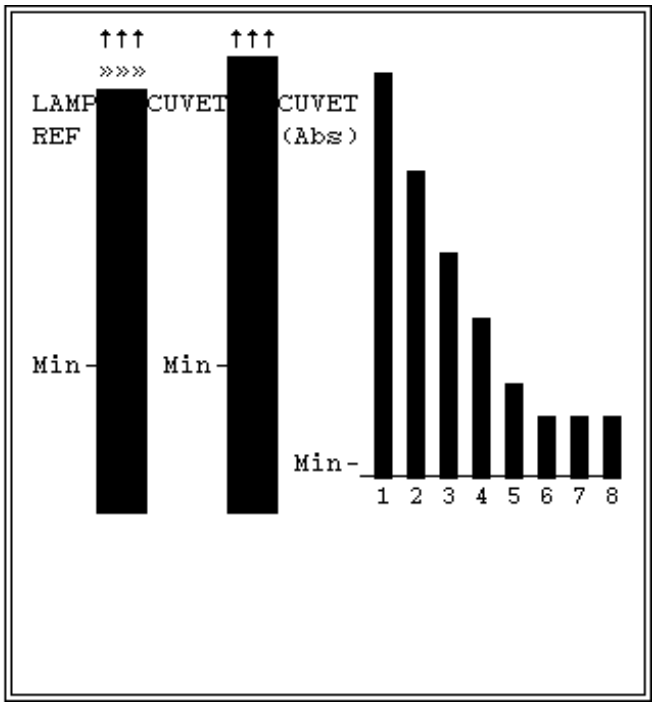
Replacing the KIO of the MCB sometimes helps if it turns out that a sensor signal is present on the board but not recognised by the system.

7.2.3.4 Bad cuvette blank results

If the results of the cuvette blank are bad (low C.V. values):

- Check the lamp adjustment, if you can not get it right:
  - Exchange the lamp
  - Check lamp voltage (12 V)
  - Check sensor voltages (>100 mV)
  - Exchange Optometer board
- Exchange the cuvette rotor
- If the results are bad only for one filter exchange this filter.
- If the results are bad for certain cuvettes at all wavelengths:
  - Take out the cuvette rotor and put it back 90 degrees turned.
    After running a new cuvette blank you can see if the bad cuvettes shifted 12 places or not. If not:
    - Check lightpath and lenses on dirt and hairs
    - Check that the light beam goes through the centre of the cuvettes, with adhesive transparent tape sticked to the cuvette, wavelength 546 nm. If not change the setting of the hexacode switch on MCB A6.

7.2.4 Check filters



LAMP REF; indicates the intensity of light on the reference sensor.

CUVET indicates the intensity of light on the normal sensor.

CUVET (Abs) indicates the absorbance of the cuvette for the various filters.

The relative length of the bars that indicate the absorbances should be as in the figure, i.e. first bar longest, then every bar shorter.
If a bar is much longer or shorter than expected, this indicates a bad filter.
The 340 nm (1) and the 546 nm (6) filters are usually the first to deteriorate.

After adjustment of the lamp no infinite signs (∞) may appear on top of the bars LAMPREF and CUVET.

7.2.4.1 Water or vacuum system

If there are problems in the water or vacuum system (water overflow, no vacuum):

- select the appropriate menu and check both pumps and all the valves (you can hear them switch).
  If pumps or valves do not operate:
  - Connect a spare valve or exchange two connectors to see whether the component or the electronics is defective
  - Change valve board (check fuse first!)
  - Change system board
- Check the complete water and vacuum system systematically with the help of the service menus and the Vacuum diagram (see figure 2.12)

7.2.4.2 Liquid detection problems

If there are problems with the liquid detection first make sure that the shaft and the bearing of the needle are completely dry. Also note that the minimum sample volume is 300 microliter for normal samples, 200 microliter for controls and standards and 100 microliter for paediatrics.

Check the PLL adjustment if necessary (see paragraph 6.5).

If this is not enough:

- If the instrument gives the INFO INSUFFICIENT SAMPLE, although there is clearly enough sample turn the corresponding potentiometer 360 degrees more clockwise (more sensitive)
- If the instrument thinks it picked up sample that was not there turn the potentiometer 360 degrees counterclockwise (less sensitive)

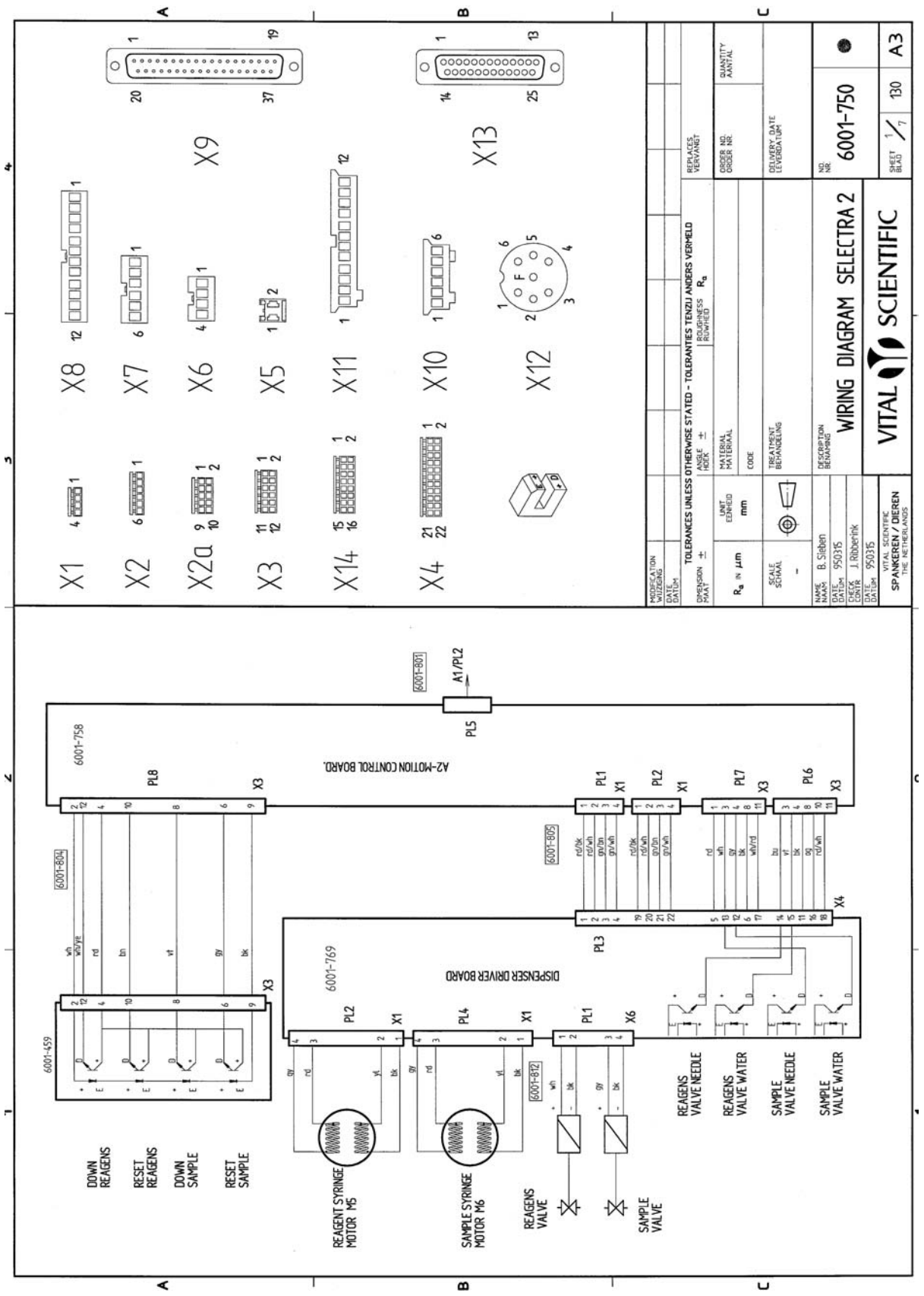
8 ELECTRICAL DIAGRAMS

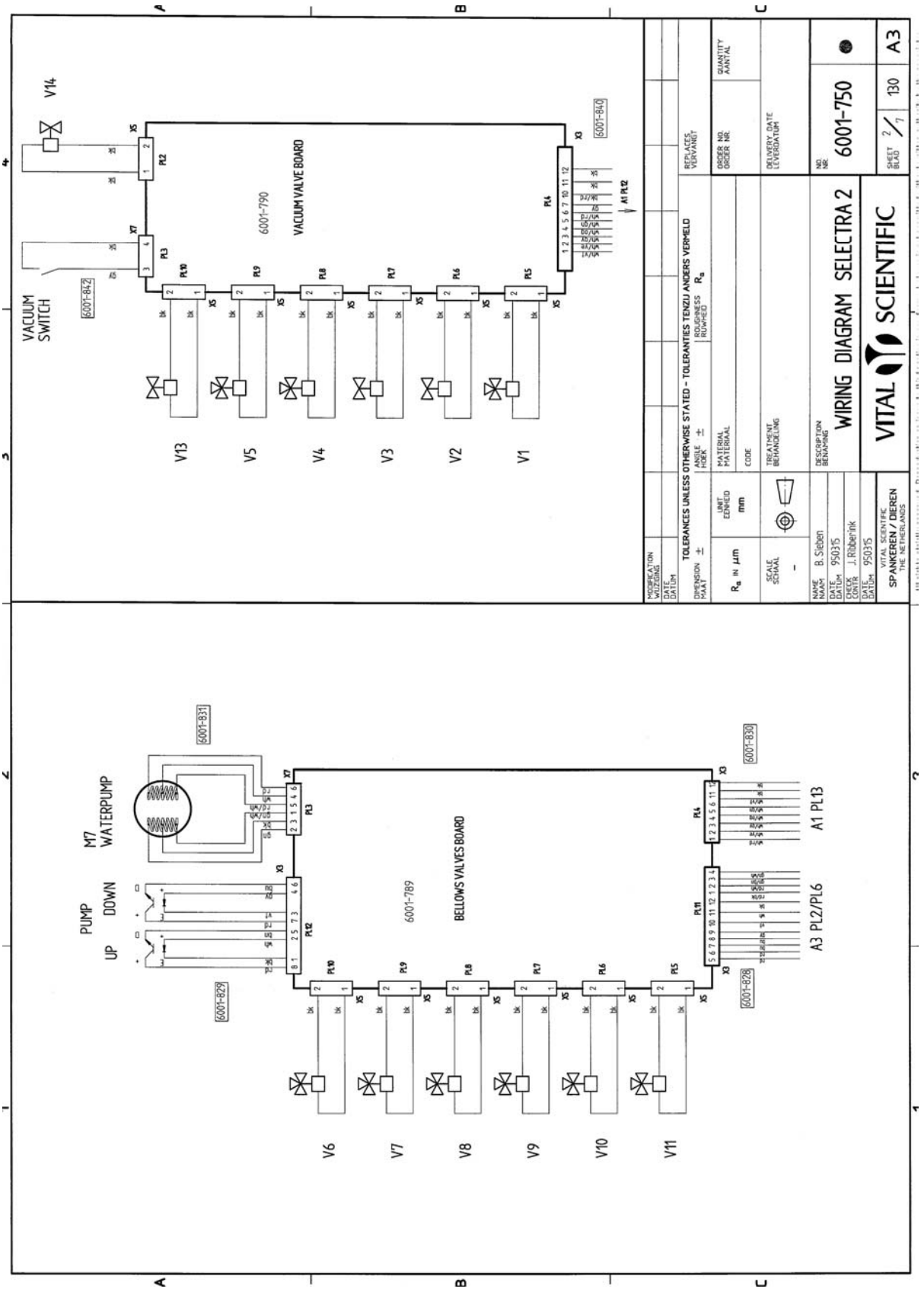
8.1 INTRODUCTION

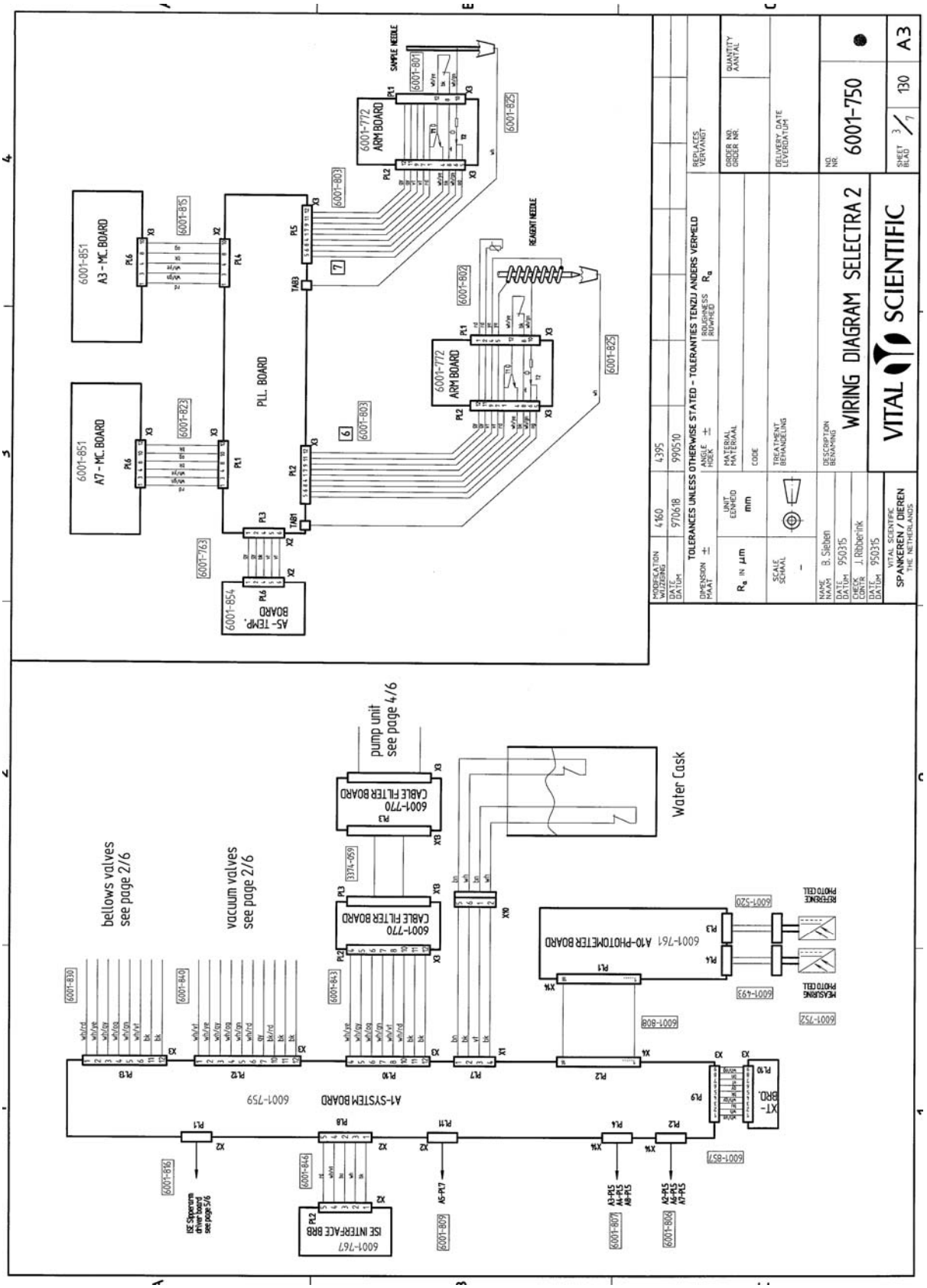
This section contains all relevant electrical diagrams and parts lists of the analyzer:

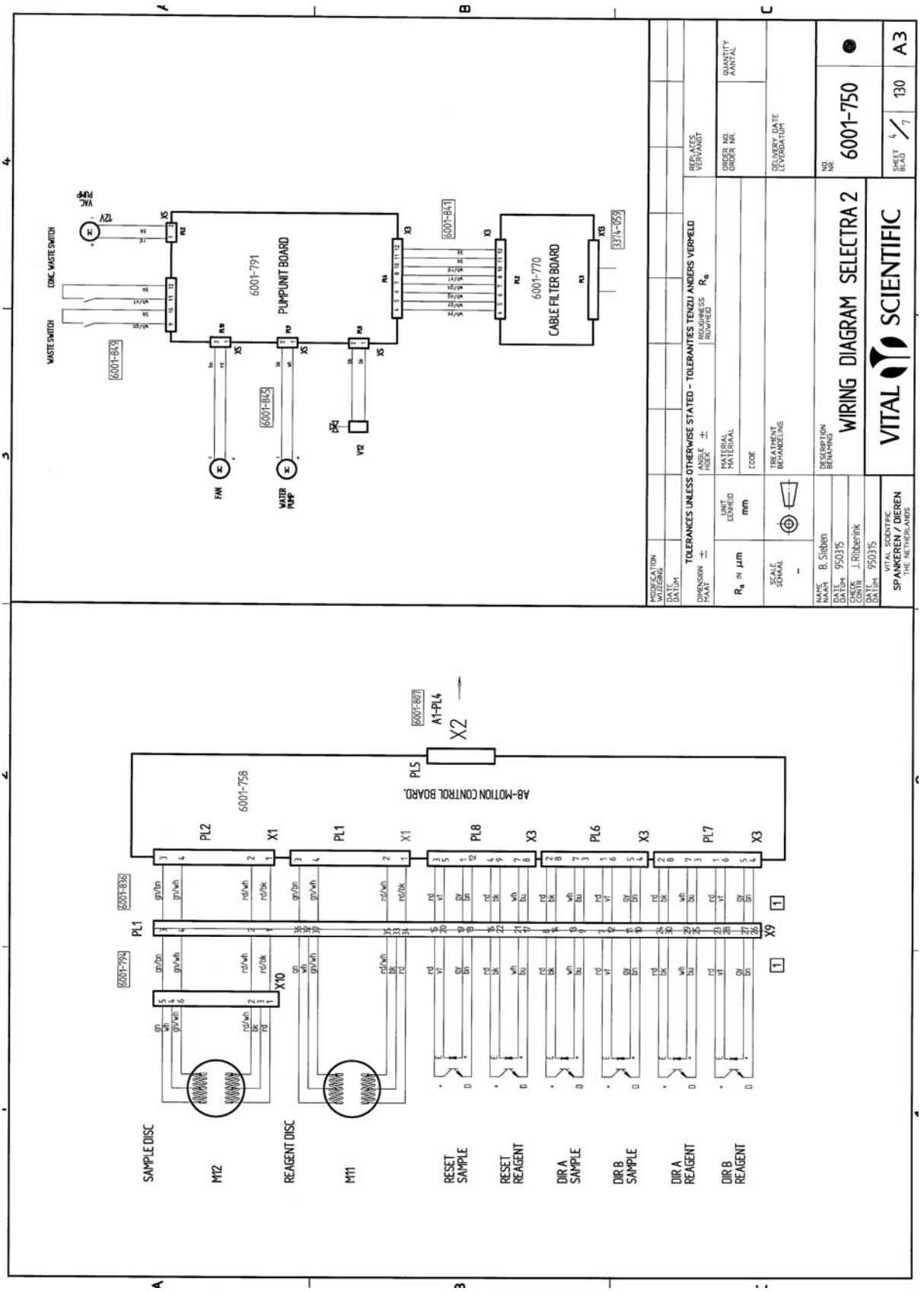
Wiring diagram	6001-750
Motion control board parts list	6001-758
Motion control board (4 sheets)	6001-758
Motion control board layout	6001-758
System board parts list	6001-759
System board (4 sheets)	6001-759
System board layout	6001-759
Photometer board parts list	6001-761
Photometer board	6001-761
Photometer board lay-out	6001-761
PLL board parts list	6001-763
PLL board	6001-763
PLL board lay-out	6001-763
ISE interface board parts list	6001-767
ISE interface board	6001-767
ISE interface board layout	6001-767
Valve board parts list	6001-768
Valve board	6001-768
Valve board layout	6001-768
Dispenser driver board parts list	6001-769
Dispenser driver board	6001-769
Dispenser driver board layout	6001-769
Cable filter parts list	6001-770
Cable filter board	6001-770
Cable filter layout	6001-770
Temperature board parts list	6001-771
Temperature board (4 sheets)	6001-771
Temperature board layout	6001-771

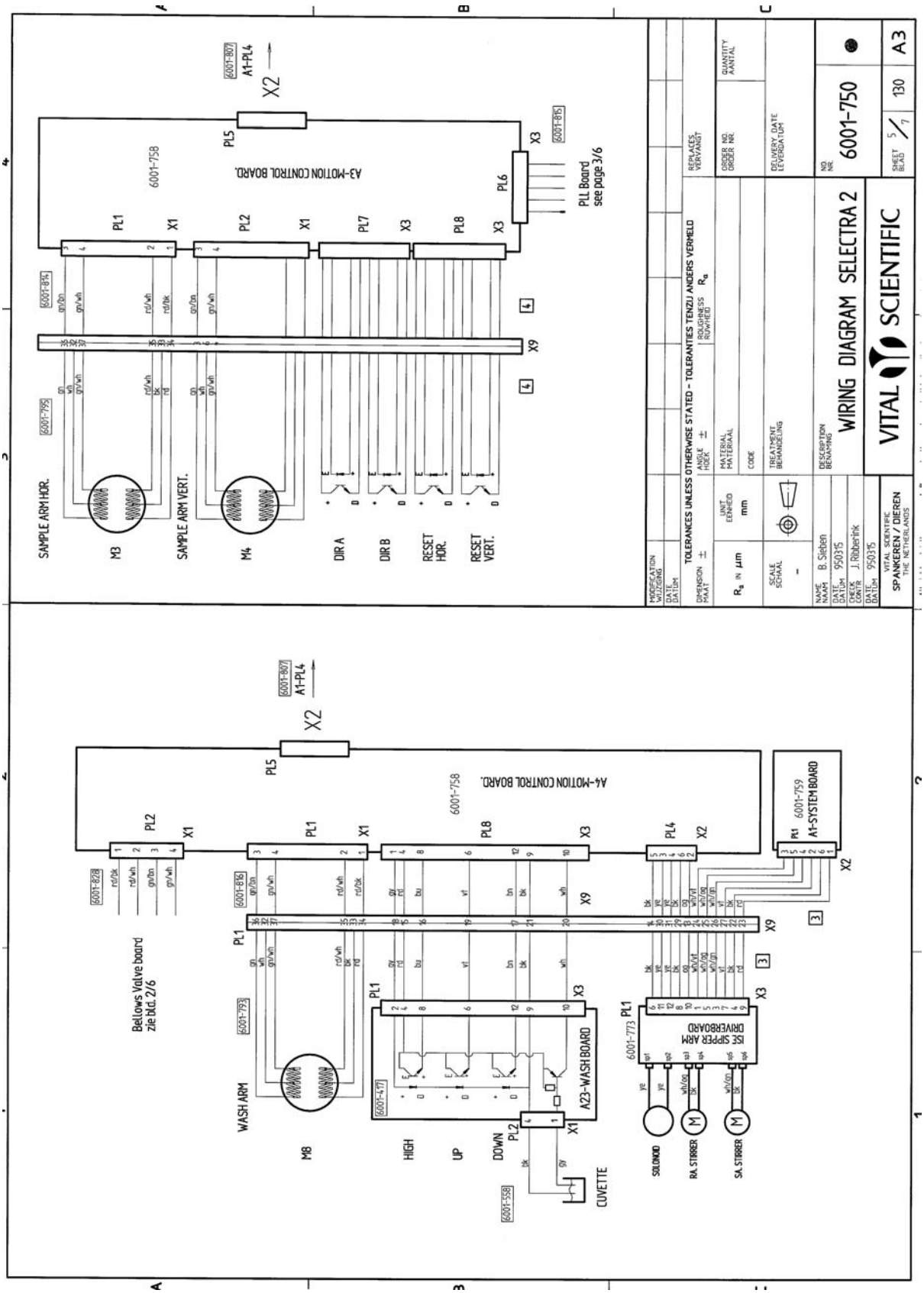
Reagent/Sample arm board parts list	6001-772
Reagent/Sample arm board	6001-772
Reagent/Sample arm board layout	6001-772
Reagent/Sample arm board	6001-955
ISE-Sipper / stirrer driver board parts list	6001-773
ISE-Sipper / stirrer driver board	6001-773
ISE-Sipper / stirrer driver board layout	6001-773
Temperature compensation board parts list	6001-858
Temperature compensation board	6001-858
Temperature compensation board layout	6001-858
Wash arm board parts list	6001-882
Wash arm board	6001-882
Wash arm board layout	6001-882
Arm reset board	6001-888
Encoder opto board	6001-900
Cooling unit diagrams	6001-956 / 6001-959

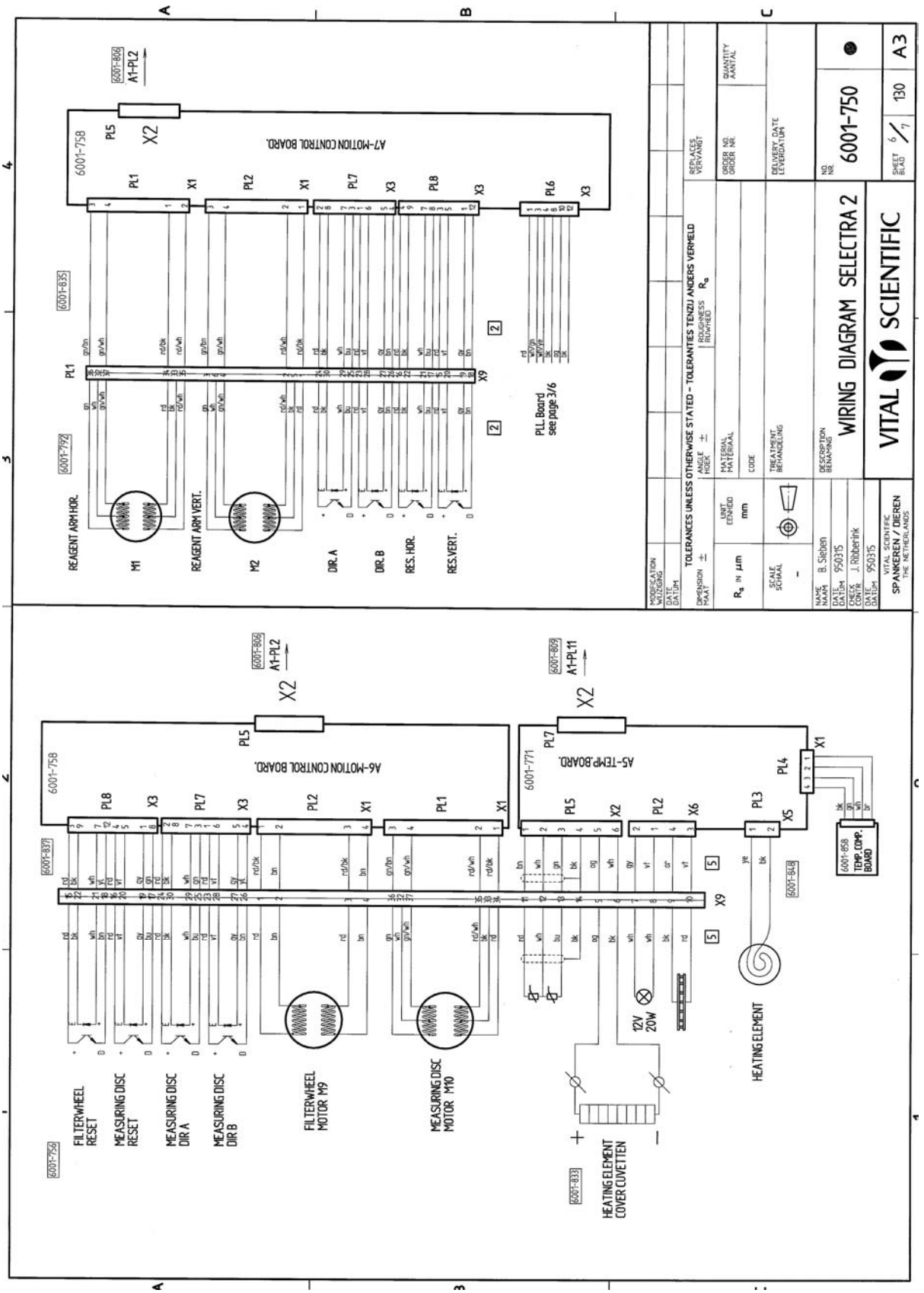

X1
X2
X2a
X3
X14
X4
X8
X7
X6
X5
X11
X10
X12
X9
X13
TOLERANCES UNLESS OTHERWISE STATED - TOLERANTIES TENZIJ ANDERS VERMELD
WIRING DIAGRAM SELECTRA 2
VITAL SCIENTIFIC
6001-750
A3
A2-MOTION CONTROL BOARD.
DISPENSER DRIVER BOARD
6001-758
6001-769
6001-459
6001-801
6001-804
6001-805
6001-812
A1/PL2
PL5
PL8
PL1
PL2
PL7
PL6
PL3
PL4
PL1
X6
DOWN REAGENS
RESET REAGENS
DOWN SAMPLE
RESET SAMPLE
REAGENT SYRINGE MOTOR M5
SAMPLE SYRINGE MOTOR M6
REAGENS VALVE
SAMPLE VALVE
REAGENS VALVE NEEDLE
REAGENS VALVE WATER
SAMPLE VALVE NEEDLE
SAMPLE VALVE WATER

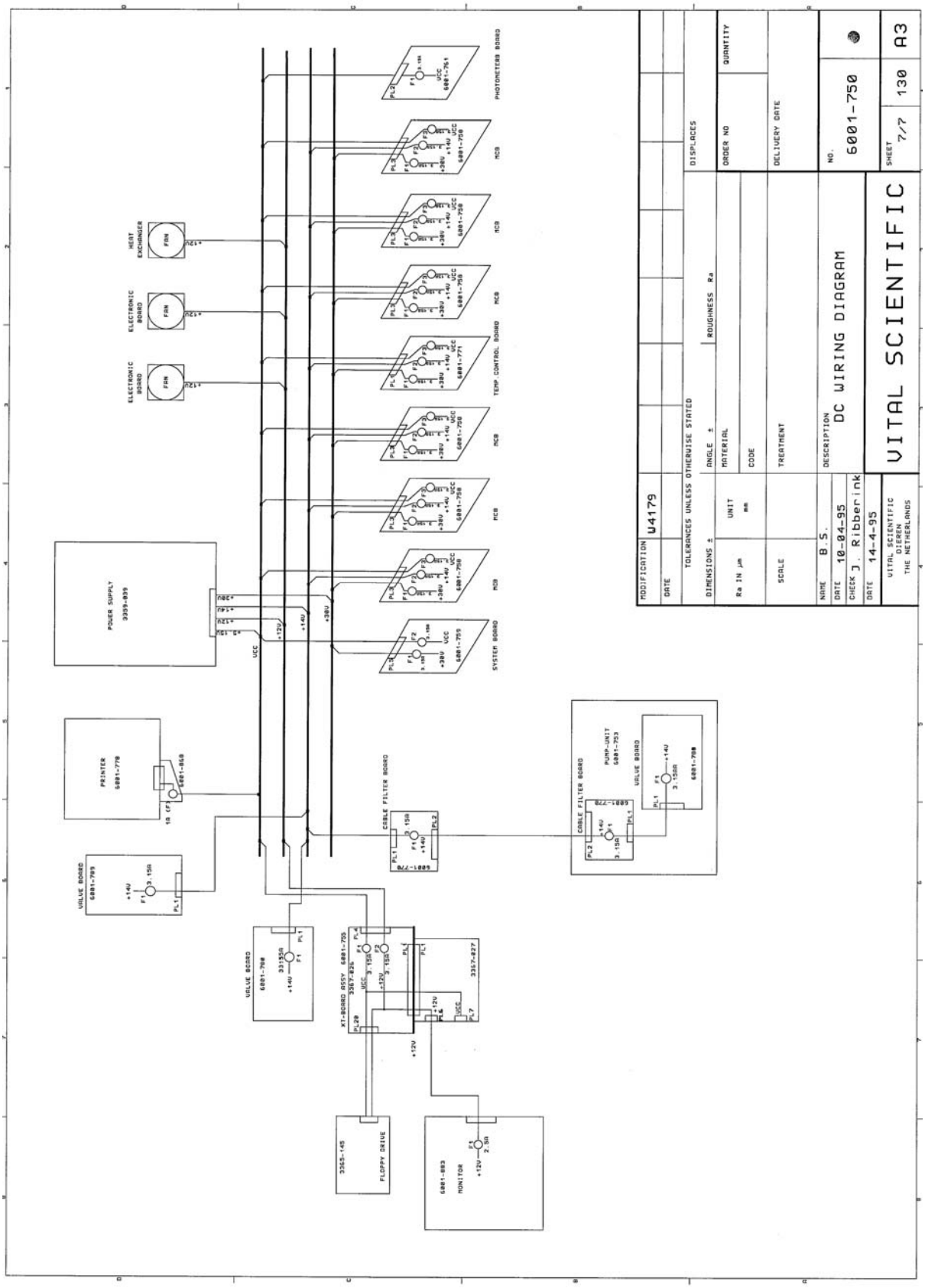

VACUUM SWITCH
6001-842
V14
6001-790
VACUUM VALVE BOARD
6001-840
V13
V5
V4
V3
V2
V1
M7 WATERPUMP
PUMP DOWN
UP
6001-831
6001-829
6001-789
BELLOWS VALVES BOARD
6001-830
6001-828
V6
V7
V8
V9
V10
V11
A1 PL13
A3 PL2/PL6
TOLERANCES UNLESS OTHERWISE STATED – TOLERANTIES TENZIJ ANDERS VERMELD
WIRING DIAGRAM SELECTRA 2
VITAL SCIENTIFIC
SPANKEREN / DIEREN
THE NETHERLANDS
6001-750
A3

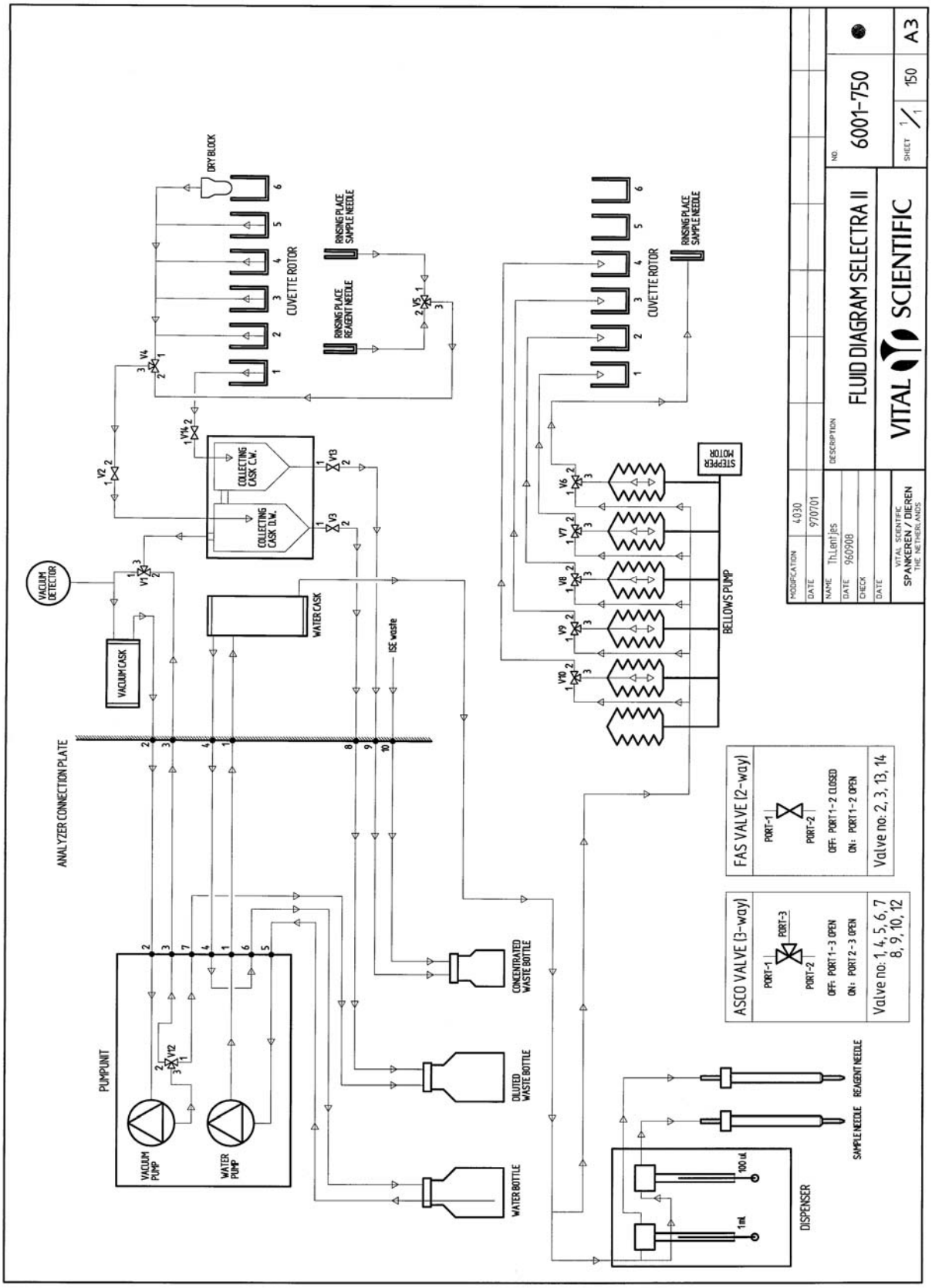

WIRING DIAGRAM SELECTRA 2
6001-750
VITAL SCIENTIFIC
SPANKEREN / DIEREN
THE NETHERLANDS
A3
130
SAMPLE NEEDLE
REAGENT NEEDLE
6001-772 ARM BOARD
6001-851 A3 - MC. BOARD
6001-851 A7 - MC. BOARD
PLL BOARD
A5- TEMP. BOARD
6001-854
6001-763
pump unit see page 4/6
Water Cask
bellows valves see page 2/6
vacuum valves see page 2/6
6001-770 CABLE FILTER BOARD
6001-761 A10-PHOTOMETER BOARD
A1-SYSTEM BOARD 6001-759
ISE INTERFACE BRD
6001-767
ISE Sipperarm driver board see page 5/6
A5-PL7
A3-PL5 A4-PL5 A6-PL5
A2-PL5 A5-PL5 A7-PL5


6001-791
PUMPUNIT BOARD
6001-770
CABLE FILTER BOARD
6001-758
A8-MOTION CONTROL BOARD
WASTE SWITCH
CONC. WASTE SWITCH
FAN
WATER PUMP
SAMPLE DISC
REAGENT DISC
RESET SAMPLE
RESET REAGENT
DIR A SAMPLE
DIR B SAMPLE
DIR A REAGENT
DIR B REAGENT
WIRING DIAGRAM SELECTRA 2
6001-750
VITAL SCIENTIFIC
SPANKEREN / DIEREN
THE NETHERLANDS


A3-MOTION CONTROL BOARD.
6001-758
PL1
PL2
PL5
PL6
PL7
PL8
X1
X2
X3
X9
6001-807
A1-PL4
6001-815
PLL Board
see page 3/6
SAMPLE ARM HOR.
SAMPLE ARM VERT.
M3
M4
DIR A
DIR B
RESET HOR.
RESET VERT.
6001-795
6001-814
A4-MOTION CONTROL BOARD.
6001-759
A1-SYSTEMBOARD
Bellows Valve board
zie blad 2/6
6001-828
6001-816
6001-793
WASH ARM
M8
6001-477
A23-WASH BOARD
HIGH
UP
DOWN
CUVETTE
6001-558
6001-773
ISE SIPPER ARM
DRIVERBOARD
SOLONOID
RA. STIRRER
SA. STIRRER
TOLERANCES UNLESS OTHERWISE STATED - TOLERANTIES TENZIJ ANDERS VERMELD
WIRING DIAGRAM SELECTRA 2
6001-750
VITAL SCIENTIFIC
SPANKEREN / DIEREN
THE NETHERLANDS
A3

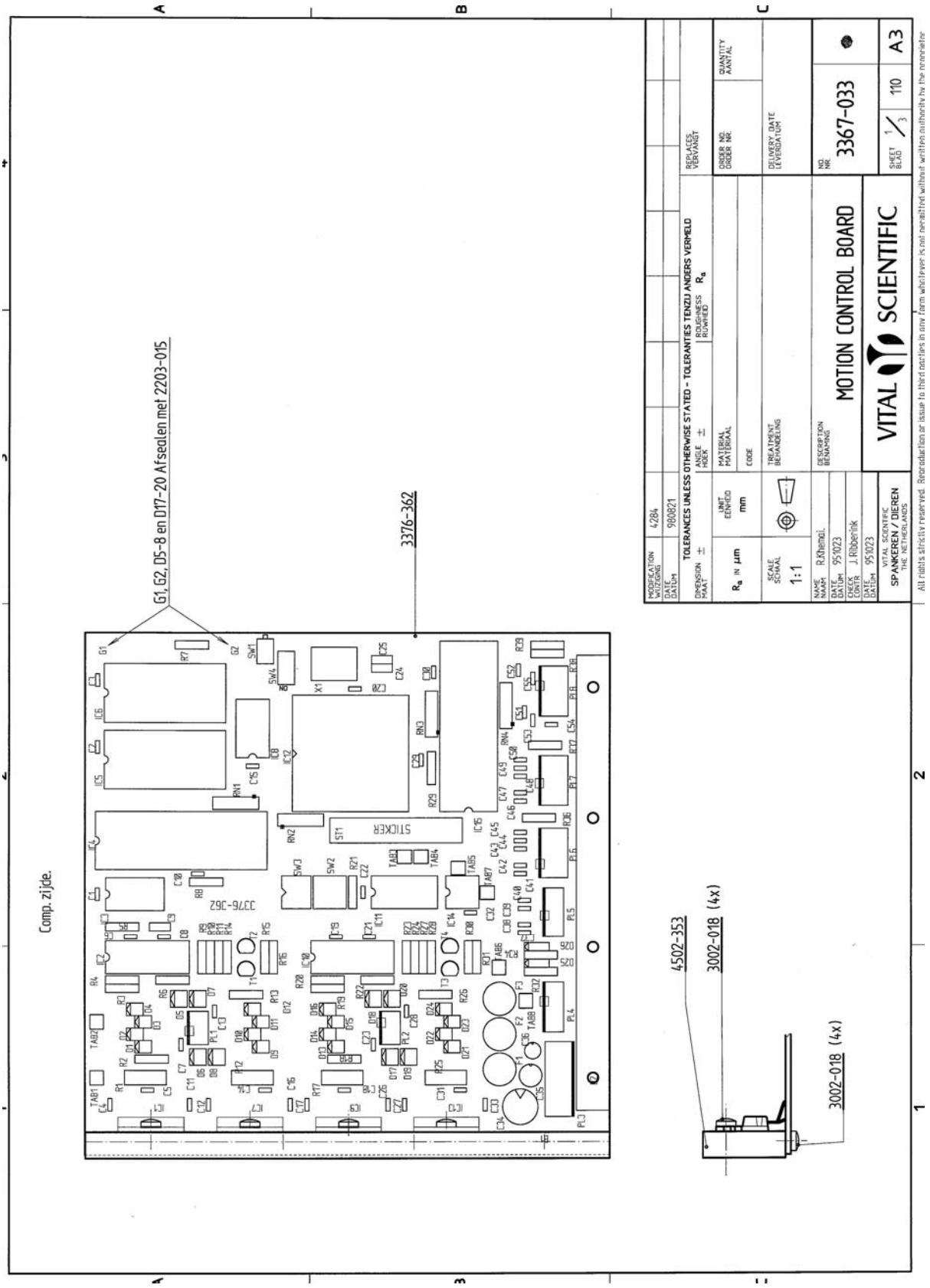

A7-MOTION CONTROL BOARD.
A6-MOTION CONTROL BOARD.
A5-TEMP.BOARD.
REAGENT ARM HOR.
REAGENT ARM VERT.
DIR. A
DIR. B
RES. HOR.
RES. VERT.
PLL Board see page 3/6
FILTERWHEEL RESET
MEASURING DISC RESET
MEASURING DISC DIR A
MEASURING DISC DIR B
FILTERWHEEL MOTOR M9
MEASURING DISC MOTOR M10
HEATING ELEMENT COVER CUVETTEN
HEATING ELEMENT
12V 20W
TEMP. COMP. BOARD
TOLERANCES UNLESS OTHERWISE STATED – TOLERANTIES TENZIJ ANDERS VERMELD
WIRING DIAGRAM SELECTRA 2
6001-750
VITAL SCIENTIFIC
SPANKEREN / DIEREN THE NETHERLANDS
B. Sieben
J. Ribbenink
A3

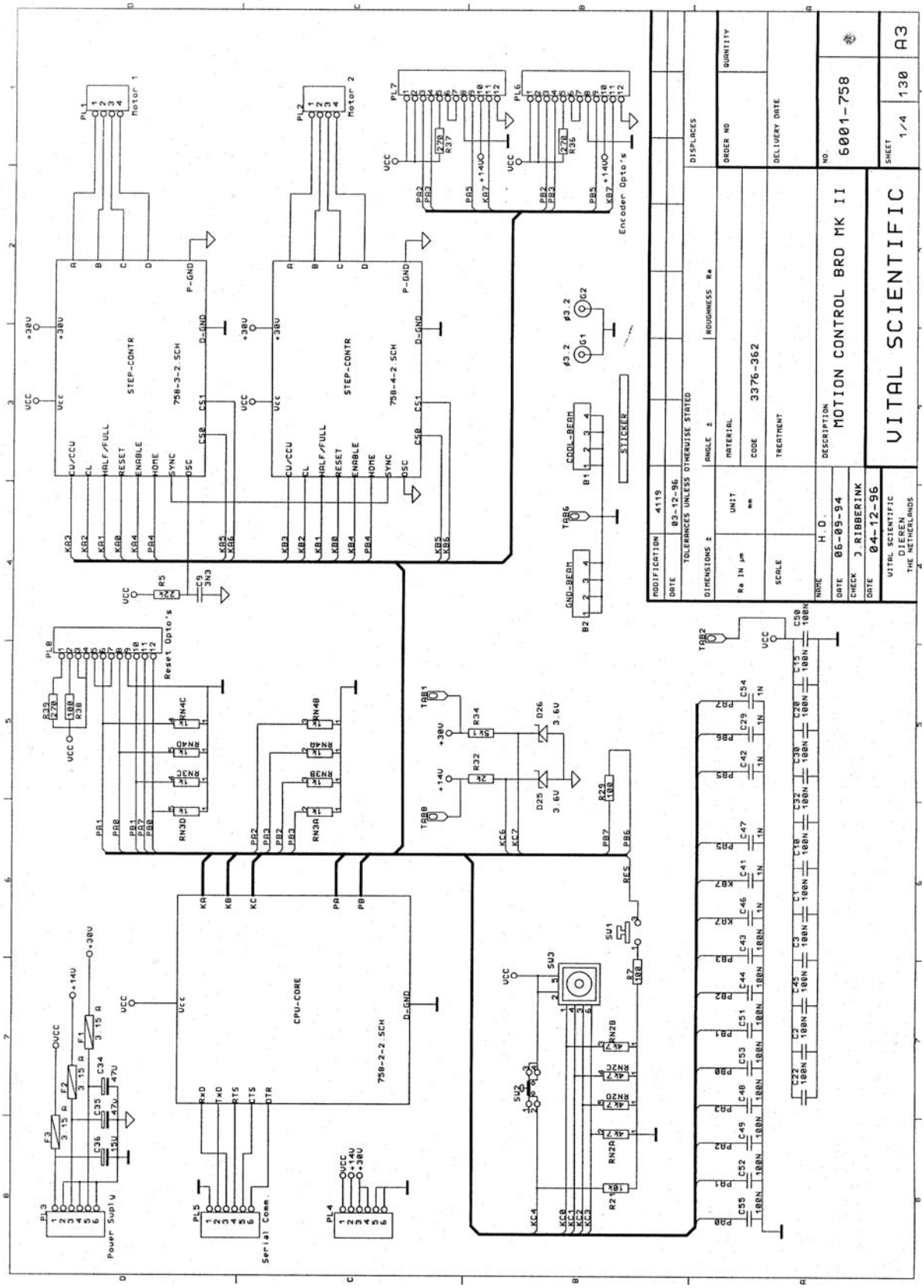

POWER SUPPLY
3359-039
PRINTER
6001-770
VALVE BOARD
6001-709
CABLE FILTER BOARD
6001-709
PUMP-UNIT
6001-753
VALVE BOARD
6001-708
VALVE BOARD
6001-704
X1-BOARD ASSY 6001-705
3357-035
3357-027
FLOPPY DRIVE
3365-145
MONITOR
6001-883
ELECTRONIC BOARD
ELECTRONIC BOARD
HEAT EXCHANGER
FAN
PHOTOMETER BOARD
MCB
TEMP CONTROL BOARD
SYSTEM BOARD
MODIFICATION U4179
DATE
TOLERANCES UNLESS OTHERWISE STATED
DIMENSIONS ±
UNIT mm
Ra IN µm
ANGLE ±
ROUGHNESS Ra
MATERIAL
CODE
TREATMENT
SCALE
DISPLACES
ORDER NO
QUANTITY
DELIVERY DATE
NAME B.S.
DATE 10-04-95
CHECK J. Ribberink
DATE 14-4-95
DESCRIPTION
DC WIRING DIAGRAM
NO. 6001-750
SHEET 7/7 130 A3
VITAL SCIENTIFIC
VITAL SCIENTIFIC
DIEMEN
THE NETHERLANDS

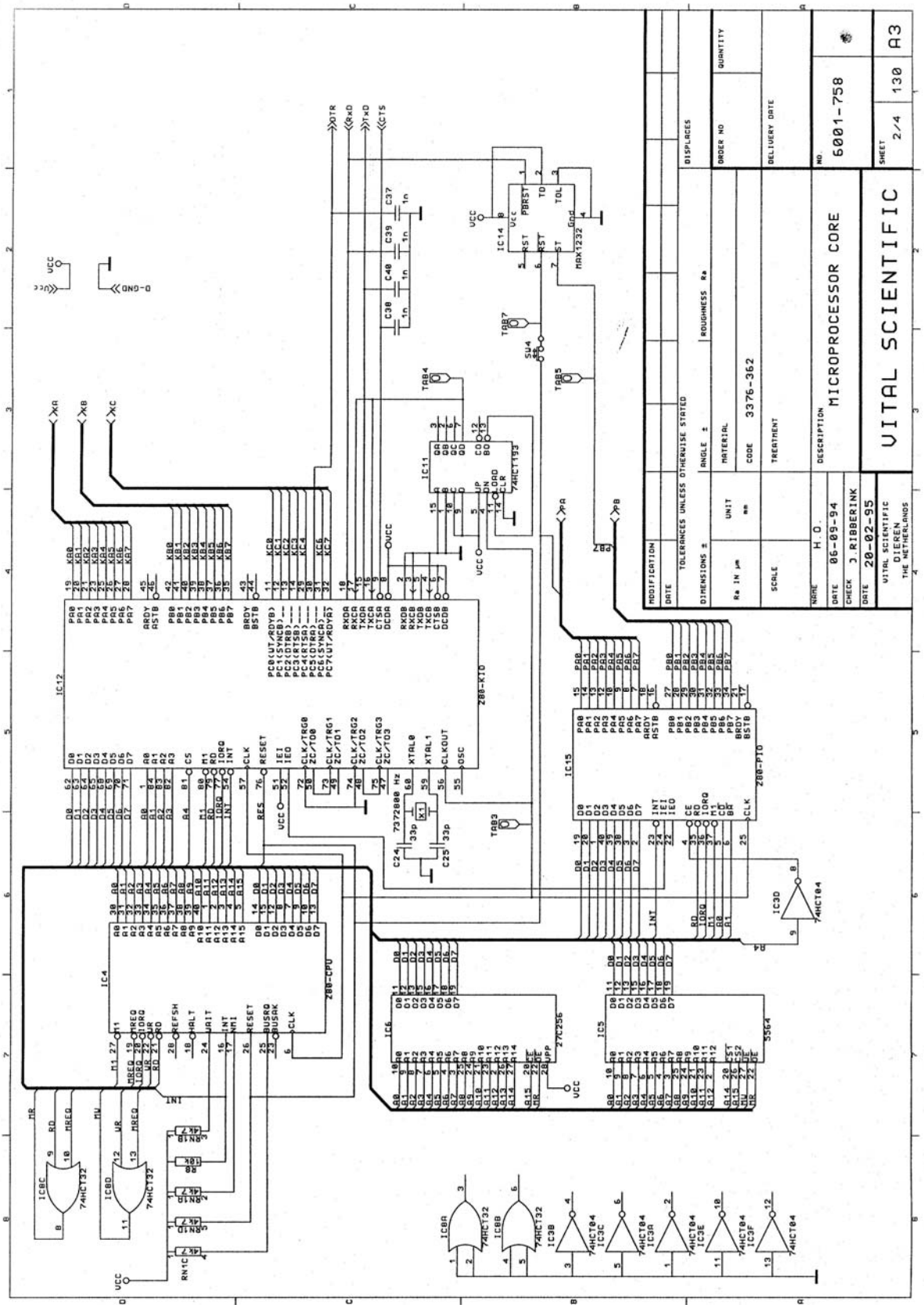

FLUID DIAGRAM SELECTRA II
6001-750
VITAL SCIENTIFIC
A3
DRY BLOCK
CUVETTE ROTOR
RINSING PLACE REAGENT NEEDLE
RINSING PLACE SAMPLE NEEDLE
COLLECTING CASK C.W.
COLLECTING CASK D.W.
WATER CASK
VACUUM CASK
VACUUM DETECTOR
ISE waste
ANALYZER CONNECTION PLATE
PUMP UNIT
VACUUM PUMP
WATER PUMP
CONCENTRATED WASTE BOTTLE
DILUTED WASTE BOTTLE
WATER BOTTLE
DISPENSER
100 µl
1 ml
SAMPLE NEEDLE
REAGENT NEEDLE
BELLOWS PUMP
STEPPER MOTOR
FAS VALVE (2-way)
PORT-1
PORT-2
OFF: PORT 1-2 CLOSED
ON: PORT 1-2 OPEN
Valve no: 2, 3, 13, 14
ASCO VALVE (3-way)
PORT-3
OFF: PORT 1-3 OPEN
ON: PORT 2-3 OPEN
Valve no: 1, 4, 5, 6, 7 8, 9, 10, 12
MODIFICATION 4030
DATE 970701
NAME Th.Lentjes
DATE 960908
CHECK
DATE
VITAL SCIENTIFIC SPANKEREN / DIEREN THE NETHERLANDS
SHEET 1/1 150

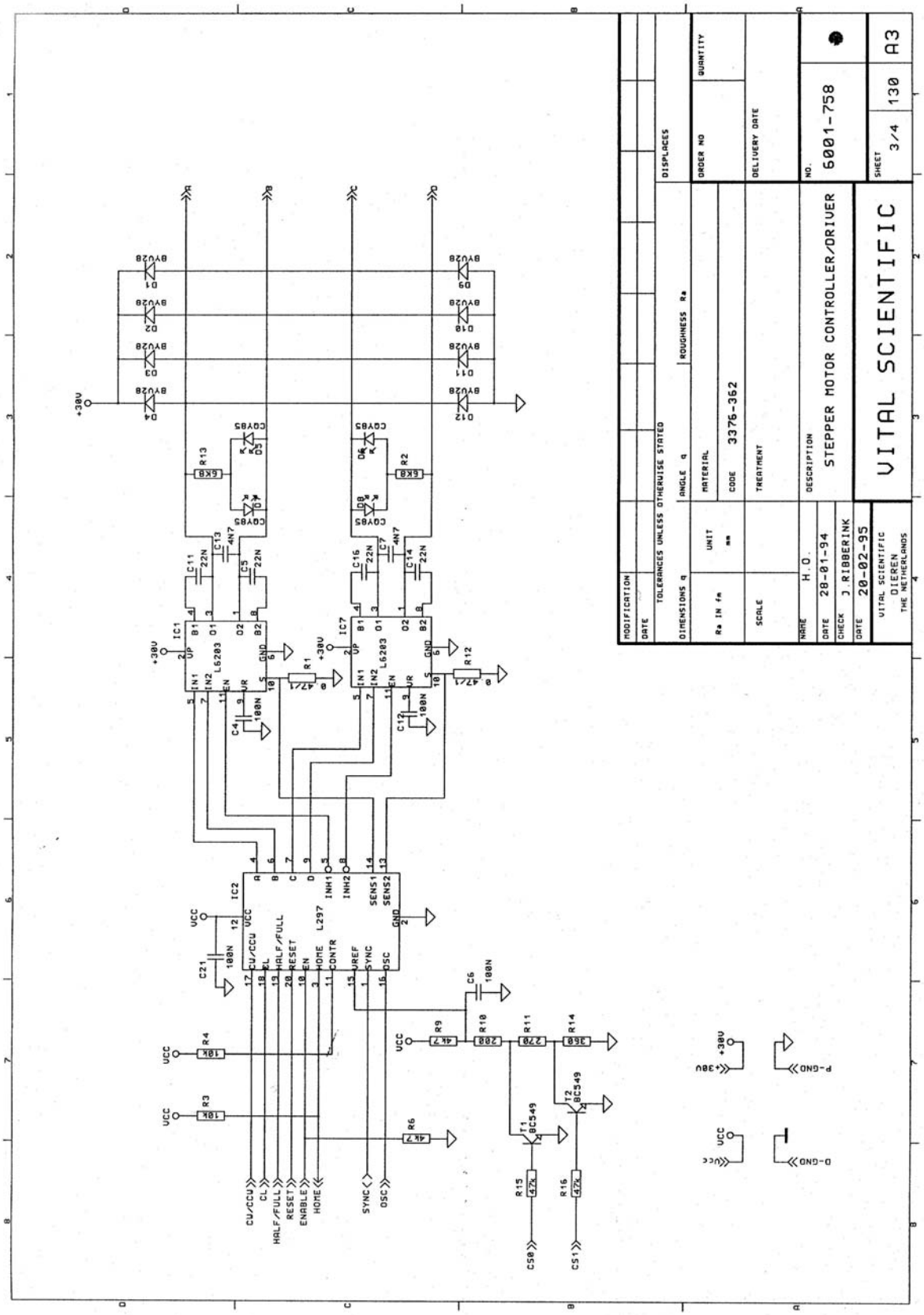
MOTION CONTROL BOARD 6001-758

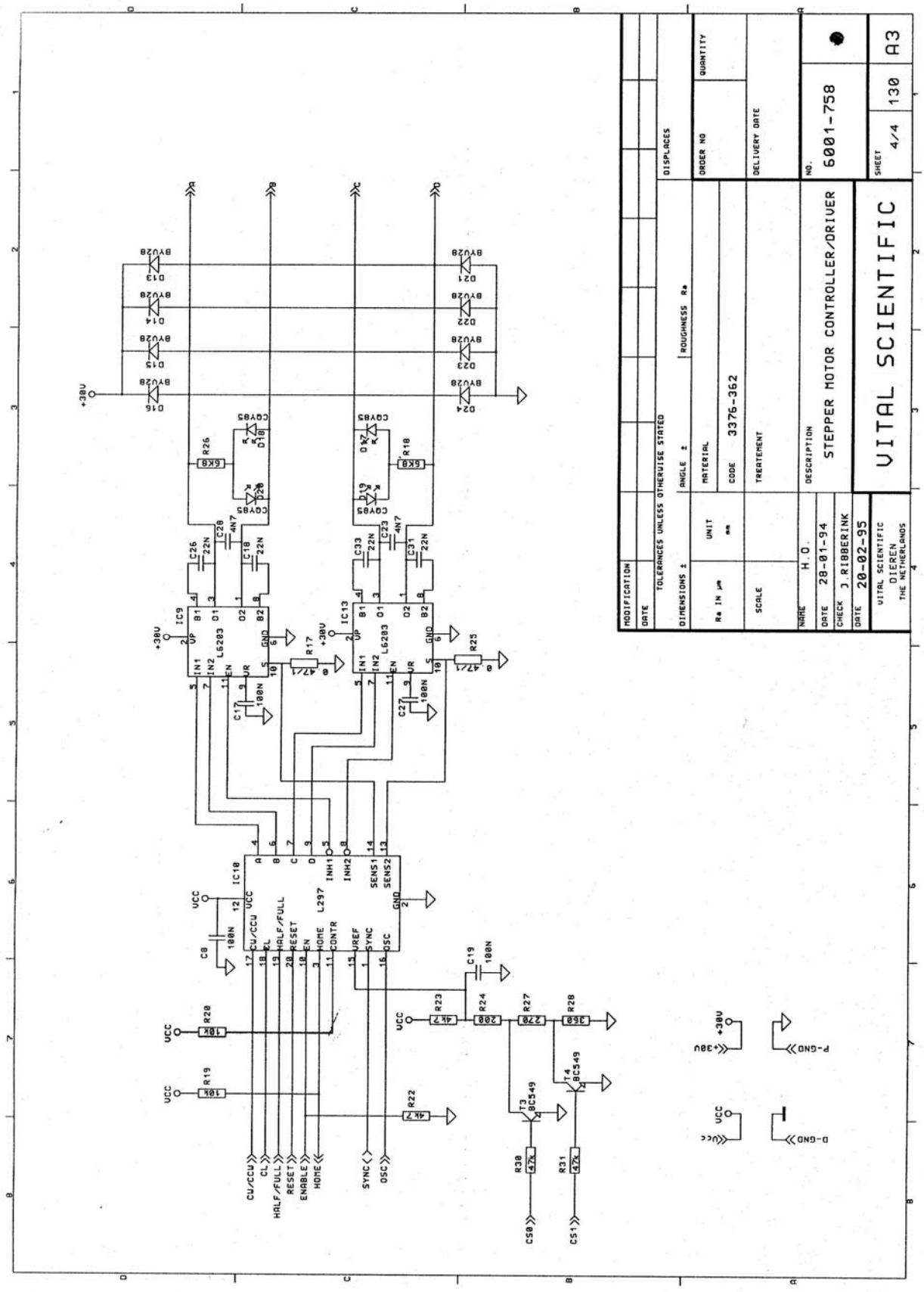
PART NUMBER	DESCRIPTION	LOCATION
3002-018	SCREW ST.ST. M3X8	
3023-006	LOCKWASHER J 3.2	
3302-301	RES.METAL 100 OHM	R 7,29,38
3302-329	RES.METAL 200 OHM	R 10,24
3302-341	RES.METAL 270 OHM	R 11,27
3302-353	RES.METAL 360 OHM	R 14,28
3302-373	RES.METAL 560 OHM (A: 270)	R 36,37,39
3302-429	RES.METAL 2K OHM	R 32
3302-465	RES.METAL 4K7 OHM	R 6,9,22,23
3302-469	RES.METAL 5K1 OHM	R 34
3302-481	RES.METAL 6K8 OHM	R 2,13,18,26
3302-501	RES.METAL 10K OHM	R 3,4,8,19, 20,21
3302-533	RES.METAL 22K OHM	R 5
3302-565	RES.METAL 47K OHM	R15,16,30,31
3304-105	RES. 0.47 OHM 1W	R 1,12,17,25
3315-009	RES.N.W. 4X4K7 (A: 4 x 1K0)	RN 1-4
3320-110	CAP. CER. AXIAL 1 nF 50V	C 29,37-42, 46,47,54
3320-150	CAP.CER. 4,7NF 40V	C 9
3320-151	CAP. CER. AXIAL 4.7nF 50V	C 7,13,23,28
3320-233	CAP. CER. AXIAL 22nF 50V	C 5,11,14,16,18,26,31,33
3320-310	CAP. CER. AXIAL 100nF 50V	C 1-4,6,8,10,12,15,17,19,20-22,30,32,33-45,48-53, 5,27
3320-942	CAP.CERAMIC 33pF 100V	C 24,25
3326-521	CAP.ELC. 15uF 20V	C 36
3326-551	CAP.ELC 47UF 20V	C 35
3326-554	CAP.ELC. 47uF / 63V	C 34
3330-045	DIODE BYV 28-100/100V	D 1-4,9-16,21-24
3330-304	DIODE ZENER ZPD 3.6V	D 25,26
3331-004	TRANS. BC 549 B	T 1-4
3333-544	L 6203 DMOS FULL-BRIDGE DR.	IC 1,7,9,13
3335-004	IC 74 HCT 04	IC 3
3335-032	IC 74 HCT 32	IC 8
3335-193	IC 74 HCT 193	IC 11
3336-008	Z84C00 Z80 CPU	IC 4
3336-009	Z84 C20-4 PI0	IC 15
3336-022	IC TC 5564 PL-15	IC 5
3336-050	L 297 STEPPER MOTOR CONTR.	IC 2,10
3336-060	IC Z80-KIO	IC 12
3336-063	MICRO MONITOR CHIP DS1232	IC 14
3342-217	SWITCH PUSHBUTTON	SW 1
3342-229	SWITCH PUSH BUTTON	SW 2
3342-311	SWITCH SLIDE 0-161390-1	SW 4
3342-516	SWITCH ROTARY HEX CODED	SW 3
3348-191	FUSE 3.15A SLOW	F 1-3
3350-006	CONN.FAST 2.8X0.5	TAB 1-8
3351-235	CONN. 4POL 826467-4	PL 1,2
3352-011	CONN 280611-2	PL 3
3352-014	CONN.6-POLE 826467-6	PL 4,5
3353-056	CONN. 2X6 POL. 826469-6	PL 6-8
3353-340	CONN.PCB.DIL 28PF	IC 5,6
3353-345	CONN.PCB.DIL 40	IC 4,15
3353-384	CONN. 84P-PLCC,0-0821573-1	IC 12
3355-002	KEYING PLUG 926498-1	PL 1,2,4-8
3366-006	FUSE HOLDER PCB MOUNT.FOR TR5	F 1-3
3370-116	RING	
3376-362	MOTION CONTROL PC. BOARD	
3380-330	LED.RED	D 5-8,17-20
3390-027	CRYSTAL 7.3728 Mc-HC 18	X 1
3820-115	STICKER	
4502-353	BEAM	A3


G1, G2, D5-8 en D17-20 Afsealen met 2203-015
3376-362
Comp. zijde.
4502-353
3002-018 (4x)
3002-018 (4x)
MOTION CONTROL BOARD
VITAL SCIENTIFIC
3367-033
SPANNEREN / DIEREN
TOLERANCES UNLESS OTHERWISE STATED - TOLERANTIES TENZIJ ANDERS VERMELD
VITAL SCIENTIFIC
THE NETHERLANDS


VITAL SCIENTIFIC
MOTION CONTROL BRD MK II
6001-758
3376-362
VITAL SCIENTIFIC
DIEREN
THE NETHERLANDS
STEP-CONTR
750-3-2.SCH
750-4-2.SCH
CPU-CORE
750-2-2.SCH
Motor 1
Motor 2
Encoder Opto's
Reset Opto's
Power Supply
Serial Comm.
COOL-BEAM
GND-BEAM
STICKER

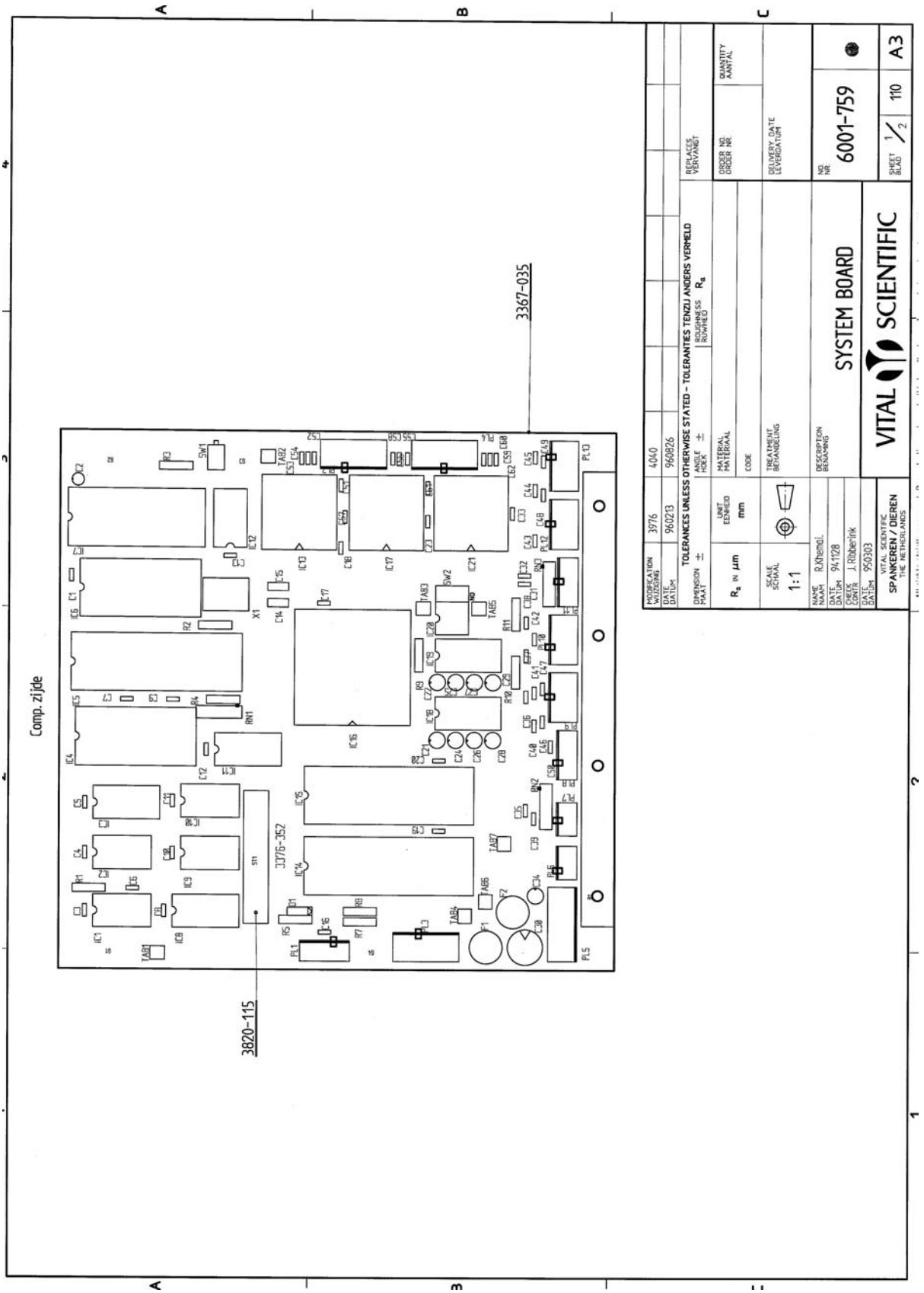

VITAL SCIENTIFIC
MICROPROCESSOR CORE
6001-758
A3
Z80-CPU
Z80-PIO
Z80-SIO
Z80-CTC
74HCT32
74HCT04
74HCT193
MAX1232
27C256
7372000 Hz
VCC
GND

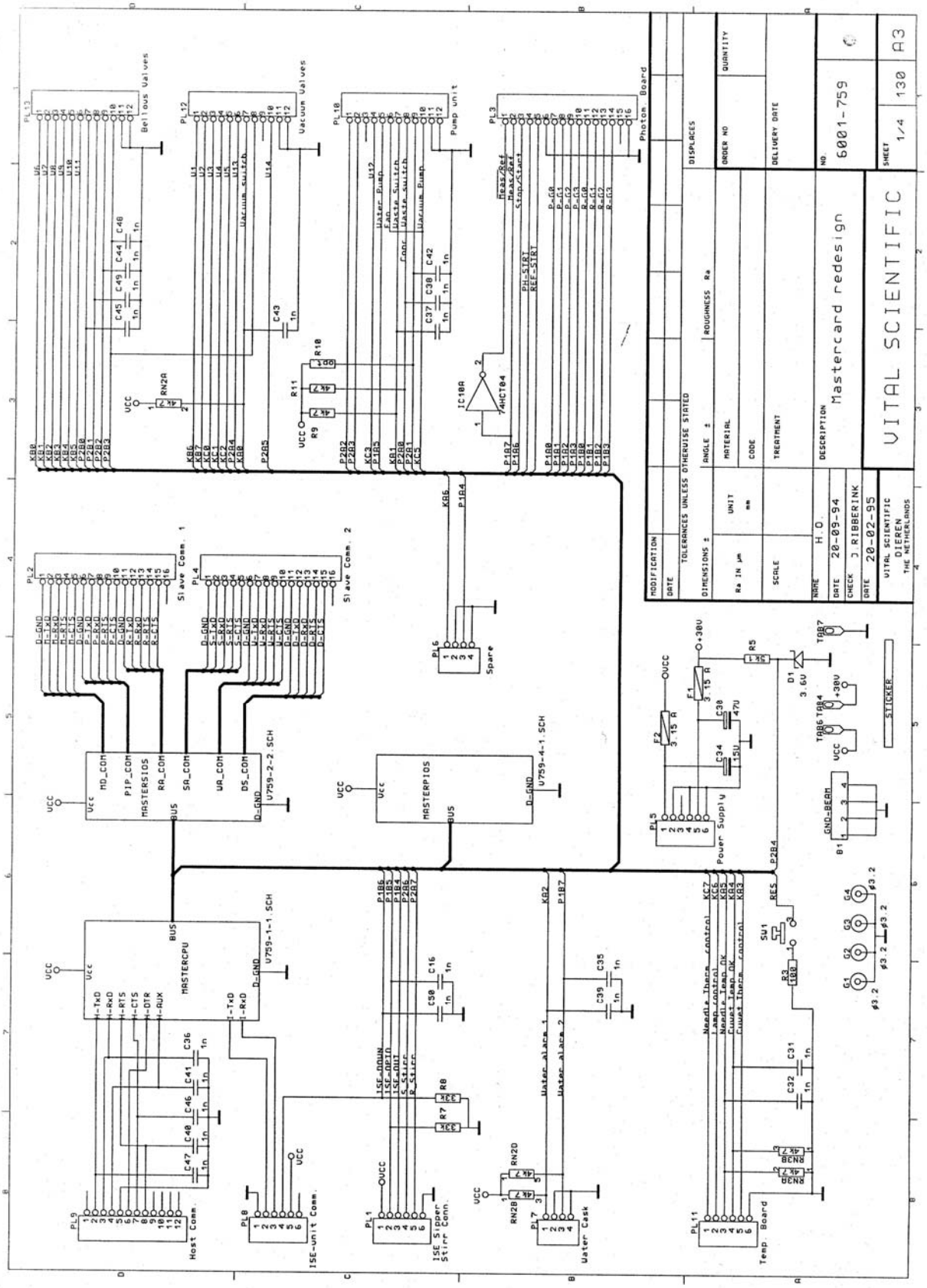

VITAL SCIENTIFIC
STEPPER MOTOR CONTROLLER/DRIVER
6001-758
3376-362
L6203
L297
BC549
BYV28
CQY83
+30V
VCC
CW/CCW
CL
HALF/FULL
RESET
ENABLE
HOME
SYNC
OSC

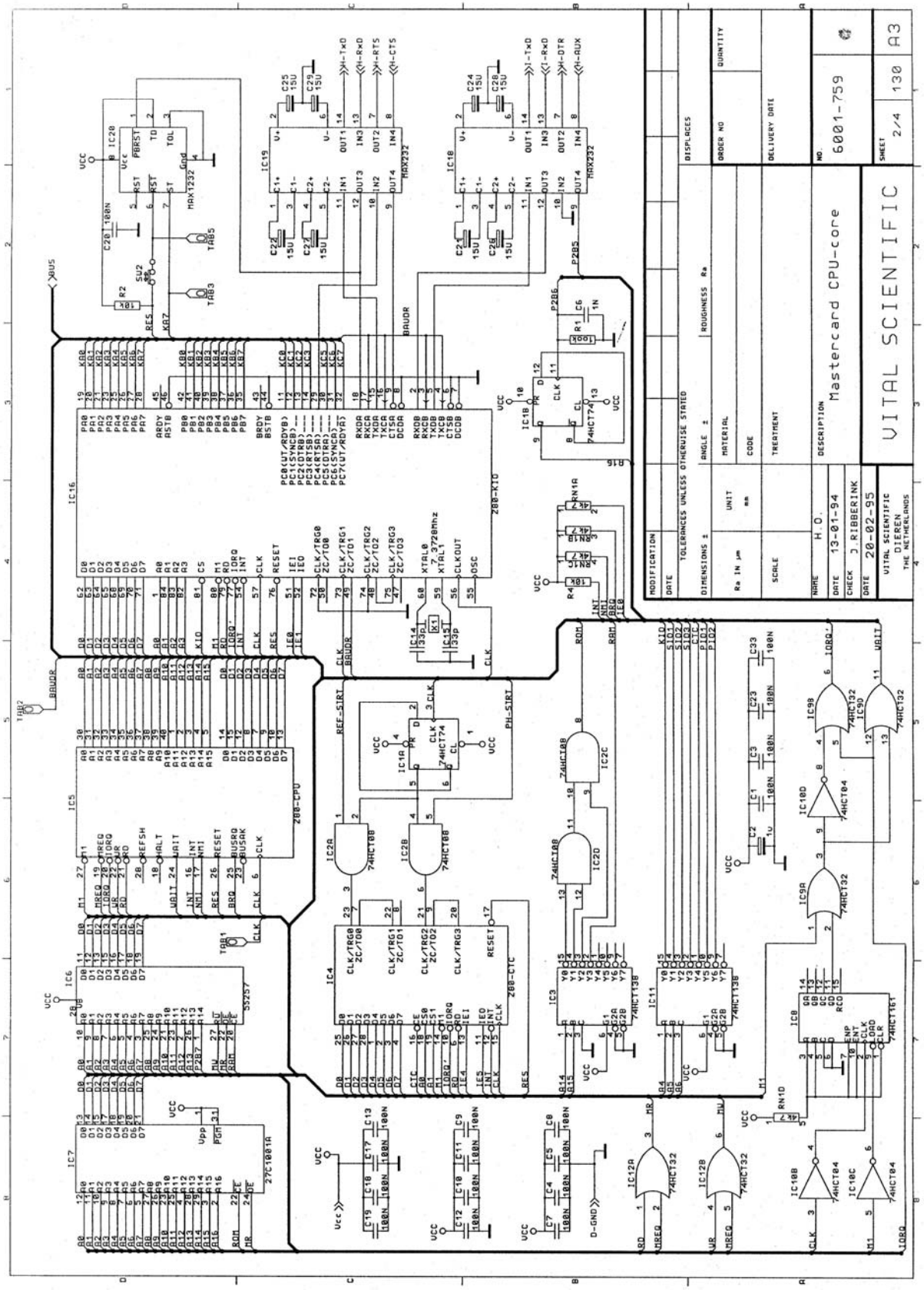

VITAL SCIENTIFIC
STEPPER MOTOR CONTROLLER/DRIVER
6001-758
3376-362
A3
L297
L6203
BC549
BYV28
CQY83
+30V
VCC
P-GND
D-GND

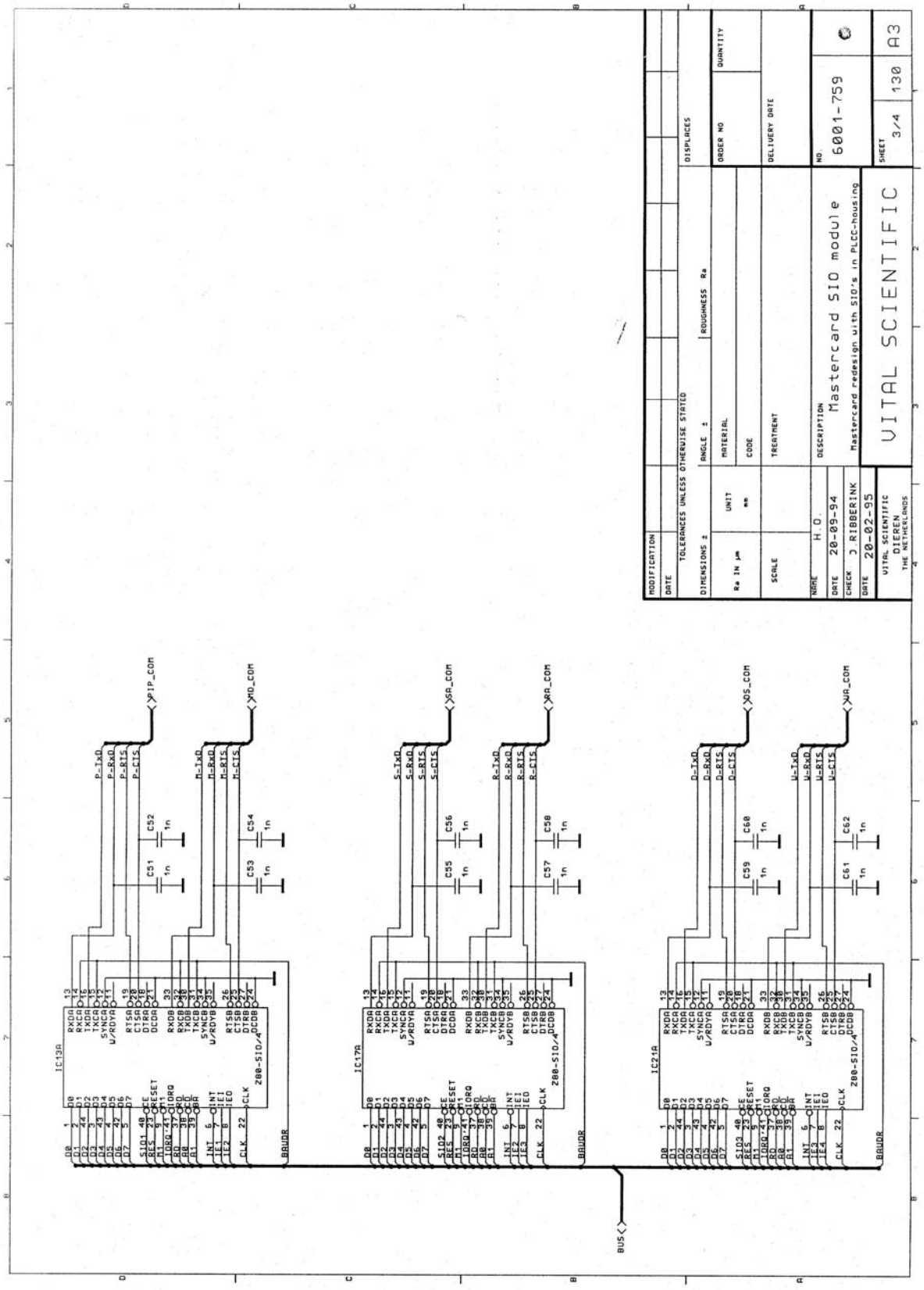
SYSTEM BOARD 6001-759

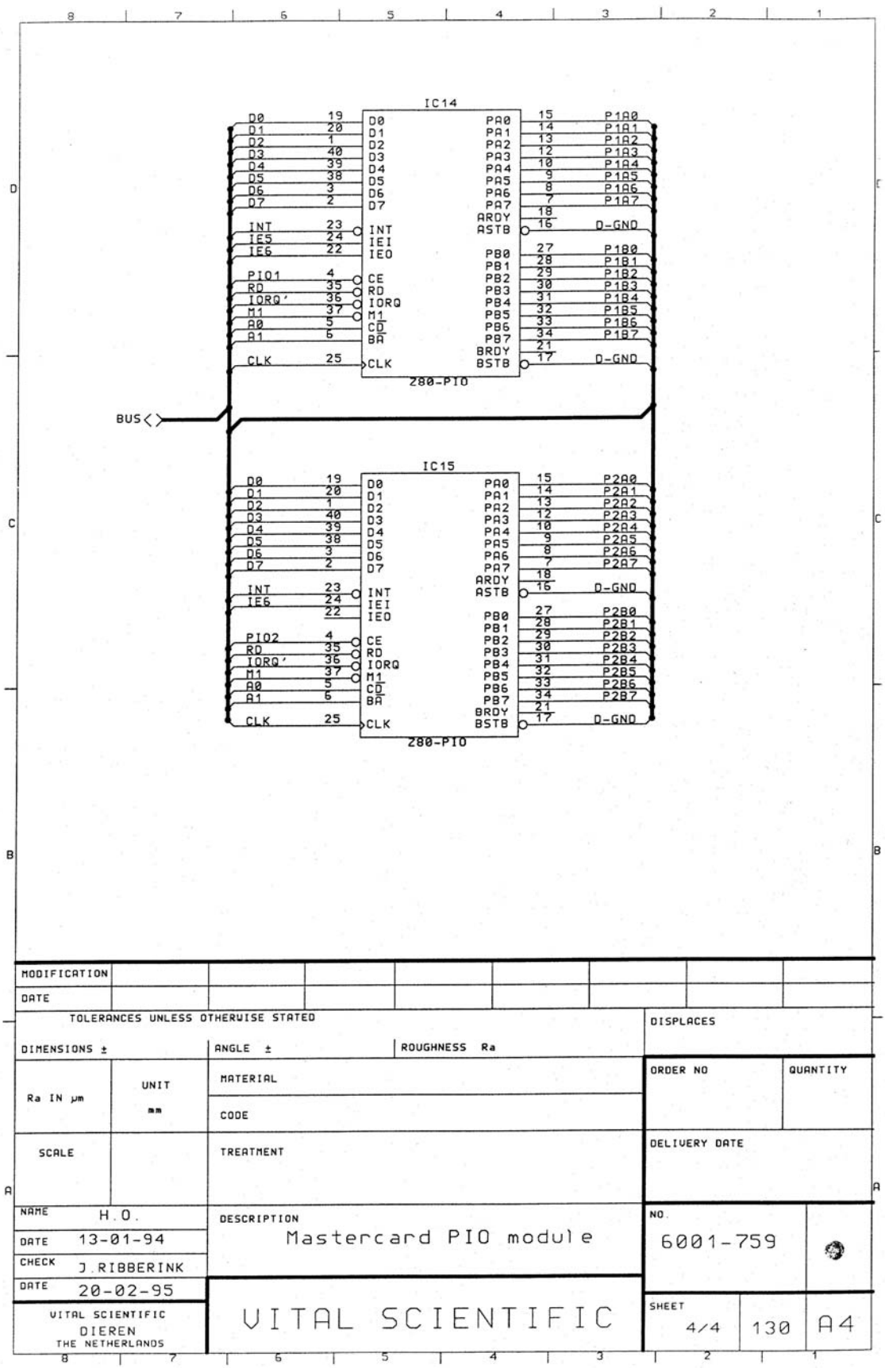
PART NUMBER	DESCRIPTION	LOCATION
3302-301	RES.METAL 100 OHM	R 3
3302-465	RES.METAL 4K7 OHM	R 9,11
3302-469	RES.METAL 5K1 OHM	R 5
3302-501	RES.METAL 10K OHM	R 2,4
3302-549	RES.METAL 33K OHM	R 7,8
3302-601	RES.METAL 100K OHM	R 1
3315-009	RES.N.W. 4X4K7	RN 1-3
3320-110	CAP. CER. AXIAL 1 nF 50V	C 6,16,31,32,35-62
3320-310	CAP. CER. AXIAL 100nF 50V	C 1,3-5,7-13,17-20,23,33
3320-942	CAP.CERAMIC 33pF 100V	C 14,15
3326-410	CAP.ECLEC.TANTAL. 1uF 35V	C 2
3326-521	CAP.ELC. 15uF 20V	C 21,22,24,25-29,34
3326-554	CAP.ELC. 47uF / 63V	C 30
3330-304	DIODE ZENER ZPD 3.6V	D 1
3333-532	MA 232 CPE +5V	IC 18,19
3335-004	IC 74 HCT 04	IC 10
3335-008	IC 74 HCT 08	IC 2
3335-032	IC 74 HCT 32	IC 9,12
3335-074	IC 74 HCT 74	IC 1
3335-138	IC 74 HCT 138	IC 3,11
3335-161	IC 74HCT161	IC 8
3336-008	Z84C00 Z80 CPU	IC 5
3336-009	Z84 C20-4 PI0	IC 14,15
3336-010	Z84 C30 CTC	IC 4
3336-051	32K X 8 STATIC CMOS RAM	IC 6
3336-060	IC Z80-KIO	IC 16
3336-063	MICRO MONITOR CHIP DS1232	IC 20
3336-074	Z80 SER.IN/OUTPUT CONTR.	IC 13,17,21
3342-217	SWITCH PUSHBUTTON	SW 1
3342-311	SWITCH SLIDE 0-161390-1	SW 2
3348-191	FUSE 3.15A SLOW	F 1,2
3350-006	CONN.FAST 2.8X0.5	TAB 1-7
3351-235	CONN. 4POL 826467-4	PL 6,7
3352-011	CONN 280611-2	PL 5
3352-014	CONN.6-POLE 826467-6	PL 1,8,11
3353-056	CONN. 2X6 POL. 826469-6	PL9,10,12,13
3353-127	CONN. 16PM(180o)826469-8	PL 2-4
3353-340	CONN.PCB.DIL 28PF	IC 4,6
3353-342	CONN. 32PF IC SOCKET	IC 7
3353-344	SOLDER TAIL SOCKET 44P	IC 13,17,21
3353-345	CONN.PCB.DIL 40	IC 5,14,15
3353-384	CONN. 84P-PLCC,0-0821573-1	IC 16
3355-002	KEYING PLUG 926498-1	PL 1-4,6-13
3366-006	FUSE HOLDER PCB MOUNT.FOR TR5	F 1,2
3376-352	SYSTEM PC. BOARD	
3390-027	CRYSTAL 7.3728 Mc-HC 18	X 1
3820-115	STICKER	


3367-035
3820-115
3376-352
Comp. zijde
SYSTEM BOARD
VITAL SCIENTIFIC
6001-759
SPANKEREN / DIEREN
THE NETHERLANDS


VITAL SCIENTIFIC
Mastercard redesign
6001-759
DIMENSIONS ±
TOLERANCES UNLESS OTHERWISE STATED
ROUGHNESS Ra
DISPLACES
ORDER NO
QUANTITY
DELIVERY DATE
MATERIAL
CODE
TREATMENT
DESCRIPTION
MODIFICATION
DATE
NAME H.O.
DATE 20-09-94
CHECK J.RIBBERINK
DATE 20-02-95
VITAL SCIENTIFIC
DIEREN
THE NETHERLANDS
SHEET 1/4 130 A3
Bellows Valves
Vacuum Valves
Pump unit
Photon Board
Slave Comm. 1
Slave Comm. 2
Spare
Power Supply
GND-BEAM
STICKER
MASTERCPU
MASTERSIOS
MASTERPIOS
Host Comm.
ISE-unit Comm.
ISE Sipper Stirr Conn.
Water Cask
Temp. Board

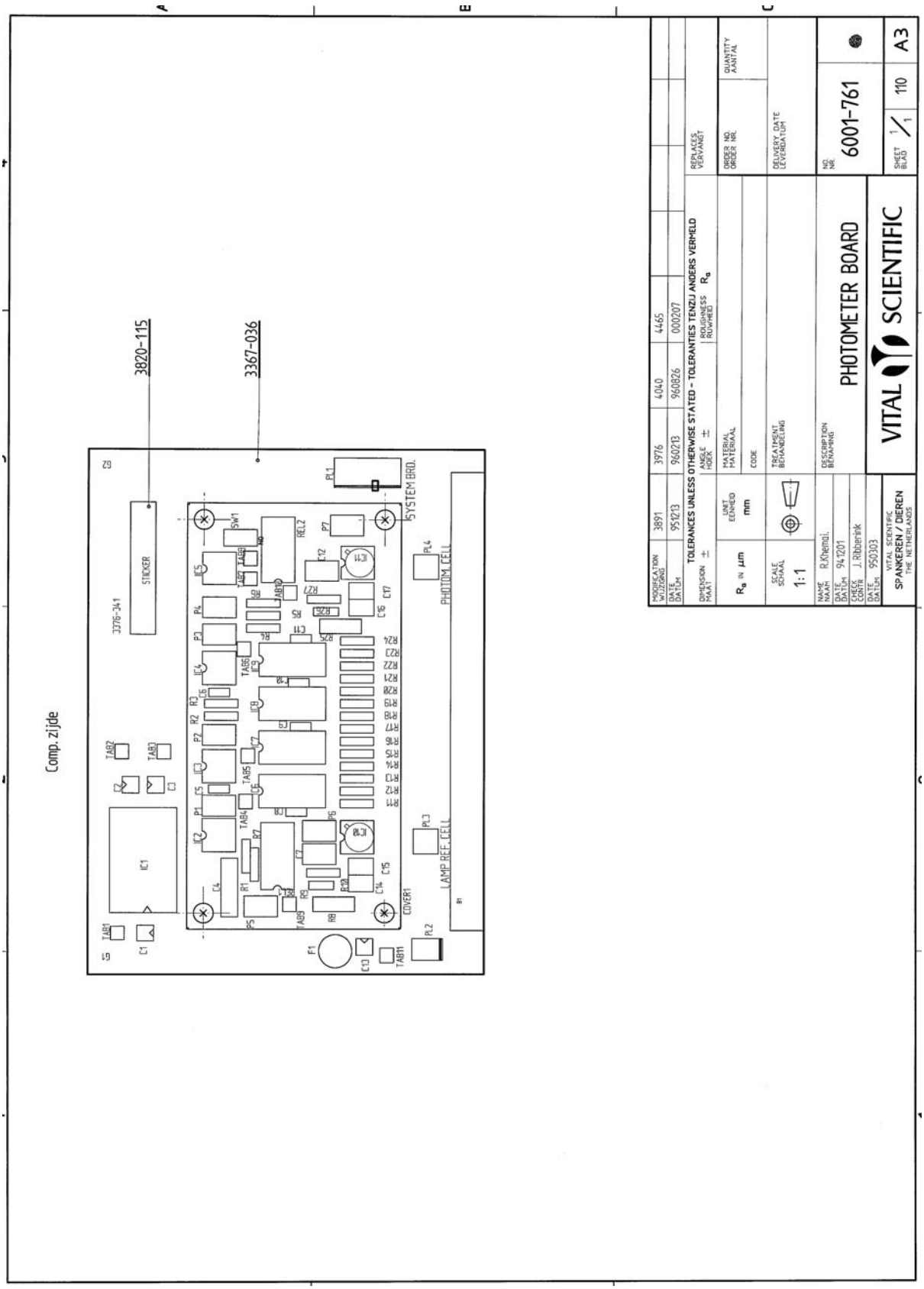

VITAL SCIENTIFIC
Mastercard CPU-core
6001-759
Z80-CPU
Z80-CTC
Z80-PIO
MAX232
74HCT138
74HCT32
74HCT04
74HCT74
74HCT08
74HCT00
74HCT161
27C1001A
7.3728Mhz
DIEREN
THE NETHERLANDS

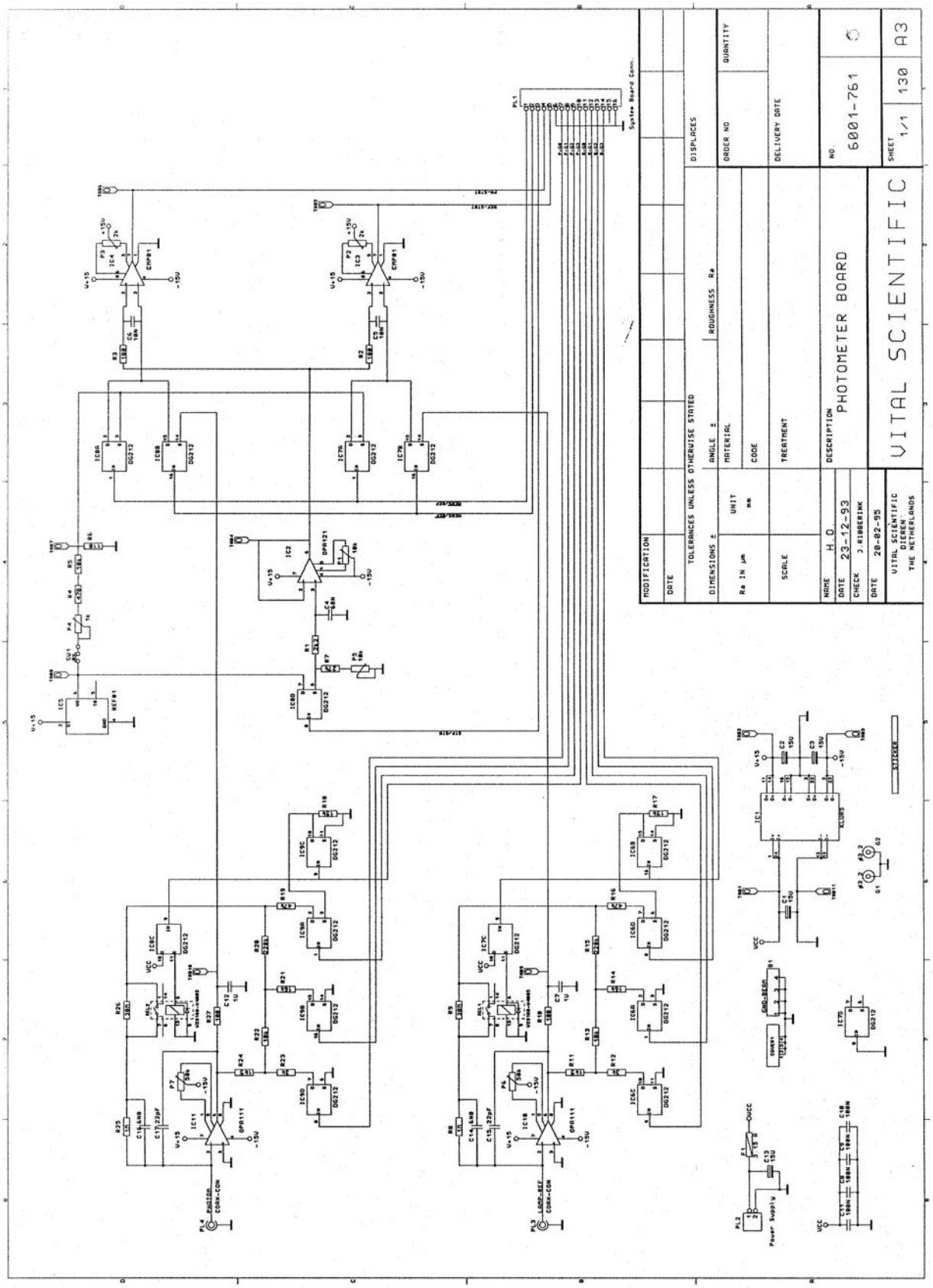

MODIFICATION
DATE
TOLERANCES UNLESS OTHERWISE STATED
DIMENSIONS ±
Ra IN µm
UNIT
mm
ANGLE ±
ROUGHNESS Ra
MATERIAL
CODE
TREATMENT
SCALE
DISPLACES
ORDER NO
QUANTITY
DELIVERY DATE
NAME H.O.
DATE 20-09-94
CHECK J.RIBBERINK
DATE 20-02-95
DESCRIPTION
Mastercard SIO module
Mastercard redesign with SIO's in PLCC-housing
NO. 6001-759
SHEET 3/4 130 A3
VITAL SCIENTIFIC
VITAL SCIENTIFIC
DIEREN
THE NETHERLANDS
IC13A
IC17A
IC21A
200-SIO/4
P-TxD
P-RxD
P-RTS
P-CTS
M-TxD
M-RxD
M-RTS
M-CTS
S-TxD
S-RxD
S-RTS
S-CTS
R-TxD
R-RxD
R-RTS
R-CTS
D-TxD
D-RxD
D-RTS
D-CTS
W-TxD
W-RxD
W-RTS
W-CTS
BAUDR
BUS
C51
C52
C53
C54
C55
C56
C57
C58
C59
C60
C61
C62
1n


IC14
D0 19
D1 20
D2 1
D3 40
D4 39
D5 38
D6 3
D7 2
INT 23
IE5 24
IE6 22
PIO1 4
RD 35
IORQ' 36
M1 37
A0 5
A1 6
CLK 25
D0 D1 D2 D3 D4 D5 D6 D7
INT IEI IEO
CE RD IORQ M1 CD BA
CLK
PA0 15 P1A0
PA1 14 P1A1
PA2 13 P1A2
PA3 12 P1A3
PA4 10 P1A4
PA5 9 P1A5
PA6 8 P1A6
PA7 7 P1A7
ARDY 18
ASTB 16 D-GND
PB0 27 P1B0
PB1 28 P1B1
PB2 29 P1B2
PB3 30 P1B3
PB4 31 P1B4
PB5 32 P1B5
PB6 33 P1B6
PB7 34 P1B7
BRDY 21
BSTB 17 D-GND
Z80-PIO
BUS
IC15
D0 19
D1 20
D2 1
D3 40
D4 39
D5 38
D6 3
D7 2
INT 23
IE6 24
22
PIO2 4
RD 35
IORQ' 36
M1 37
A0 5
A1 6
CLK 25
D0 D1 D2 D3 D4 D5 D6 D7
INT IEI IEO
CE RD IORQ M1 CD BA
CLK
PA0 15 P2A0
PA1 14 P2A1
PA2 13 P2A2
PA3 12 P2A3
PA4 10 P2A4
PA5 9 P2A5
PA6 8 P2A6
PA7 7 P2A7
ARDY 18
ASTB 16 D-GND
PB0 27 P2B0
PB1 28 P2B1
PB2 29 P2B2
PB3 30 P2B3
PB4 31 P2B4
PB5 32 P2B5
PB6 33 P2B6
PB7 34 P2B7
BRDY 21
BSTB 17 D-GND
Z80-PIO
MODIFICATION
DATE
TOLERANCES UNLESS OTHERWISE STATED
DISPLACES
DIMENSIONS ±
ANGLE ±
ROUGHNESS Ra
Ra IN µm
UNIT
mm
MATERIAL
CODE
ORDER NO
QUANTITY
SCALE
TREATMENT
DELIVERY DATE
NAME H.O.
DATE 13-01-94
CHECK J.RIBBERINK
DATE 20-02-95
DESCRIPTION
Mastercard PIO module
NO.
6001-759
VITAL SCIENTIFIC
DIEREN
THE NETHERLANDS
VITAL SCIENTIFIC
SHEET 4/4
130
A4

PHOTOMETER BOARD 6001-761

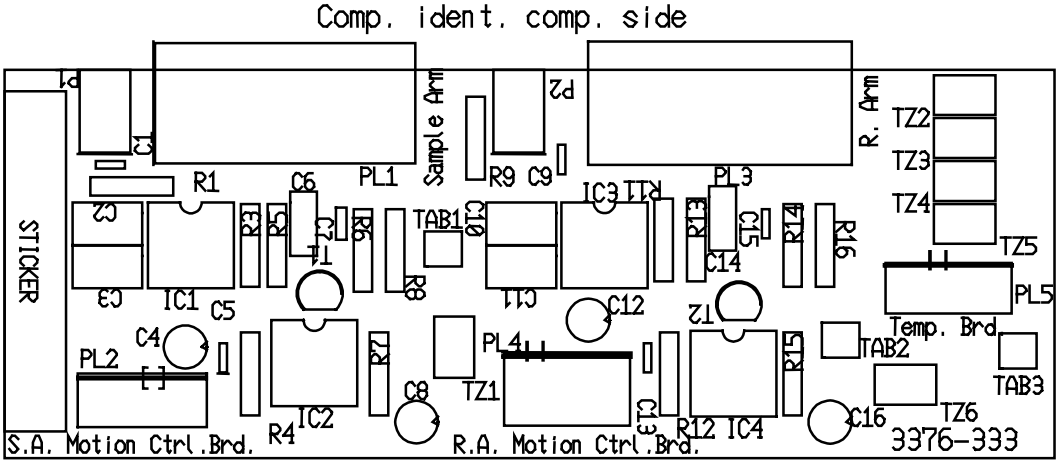
PART NUMBER	DESCRIPTION	LOCATION
3002-016	SCREW ST.ST. M3X6	
3019-009	NUT M3 (HEIGHT 15 mm)	
3023-006	LOCKWASHER J 3.2	
3302-301	RES.METAL 100 OHM	R 2,3,10,27
3302-305	RES.METAL 110 OHM	R 6
3302-365	RES.METAL 470 OHM	R 4
3302-417	RES.METAL 1K5 OHM	R 11,24
3302-433	RES.METAL 2K2 OHM	R 1
3302-445	RES.METAL 3K OHM	R 12,23
3302-501	RES.METAL 10K OHM	R 5
3302-517	RES.METAL 15K OHM	R 17,18
3302-521	RES.METAL 16K OHM	R 14,21
3302-525	RES.METAL 18K OHM	R 13,22
3302-541	RES.METAL 27K OHM	R 7
3302-565	RES.METAL 47K OHM	R 16,19
3302-633	RES.METAL 220K OHM	R 15,20
3305-249	RES.METAL 30M OHM	R 9,26
3306-701	RES.METAL 1M OHM	R 8,25
3312-112	POTM.ADJ 1K MT	P 4
3312-117	POTM.ADJ 2K MT	P 2,3
3312-132	POTM.ADJ 10K MT	P 1,5
3312-162	POTM.ADJ 50K MT	P 6,7
3320-210	CAP.CER. 10NF 40V	C 5,6
3320-311	CAP.CER. 0.1uF 50V	C 8-11
3322-020	CAP.STYROFLEX 22pF/160V	C 15,17
3323-410	CAP.P.E 1UF 63V	C 7,12
3325-162	CAP.PP 6.8NF 100V	C 14,16
3325-262	CAP.PP 0.068UF 250V	C 4
3326-521	CAP.ELC. 15uF 20V	C 1-3,13
3333-052	IC B.B. OPA 111AM	IC 10,11
3333-061	IC OPA 121KP	IC 2
3333-323	IC REF-01 HP	IC 5
3333-508	IC CMP 01 EP	IC 3,4
3333-514	IC DG 212 CJ	IC 6-9
3342-311	SWITCH SLIDE 0-161390-1	SW 1
3346-002	RELAY.REED V23100 V4005 A010	REL 1,2
3348-191	FUSE 3.15A SLOW	F 1
3350-006	CONN.FAST 2.8X0.5	TAB 1-11
3350-030	CONN. 2 POL. SUBCLIC	PL 3,4
3350-137	CONN. 2POL. 280609-2	PL 2
3353-127	CONN. 16PM(180o)826469-8	PL 1
3355-002	KEYING PLUG 926498-1	PL 1
3359-002	POWER UNIT DC CONVERTOR	IC 1
3366-006	FUSE HOLDER PCB MOUNT.FOR TR5	F 1
3370-361	MOUNTINGPAD TO 5	IC 10,11
3376-341	PHOTOMETER PC. BOARD	
3820-115	STICKER	
4801-060	COVER	A4 COVER 1

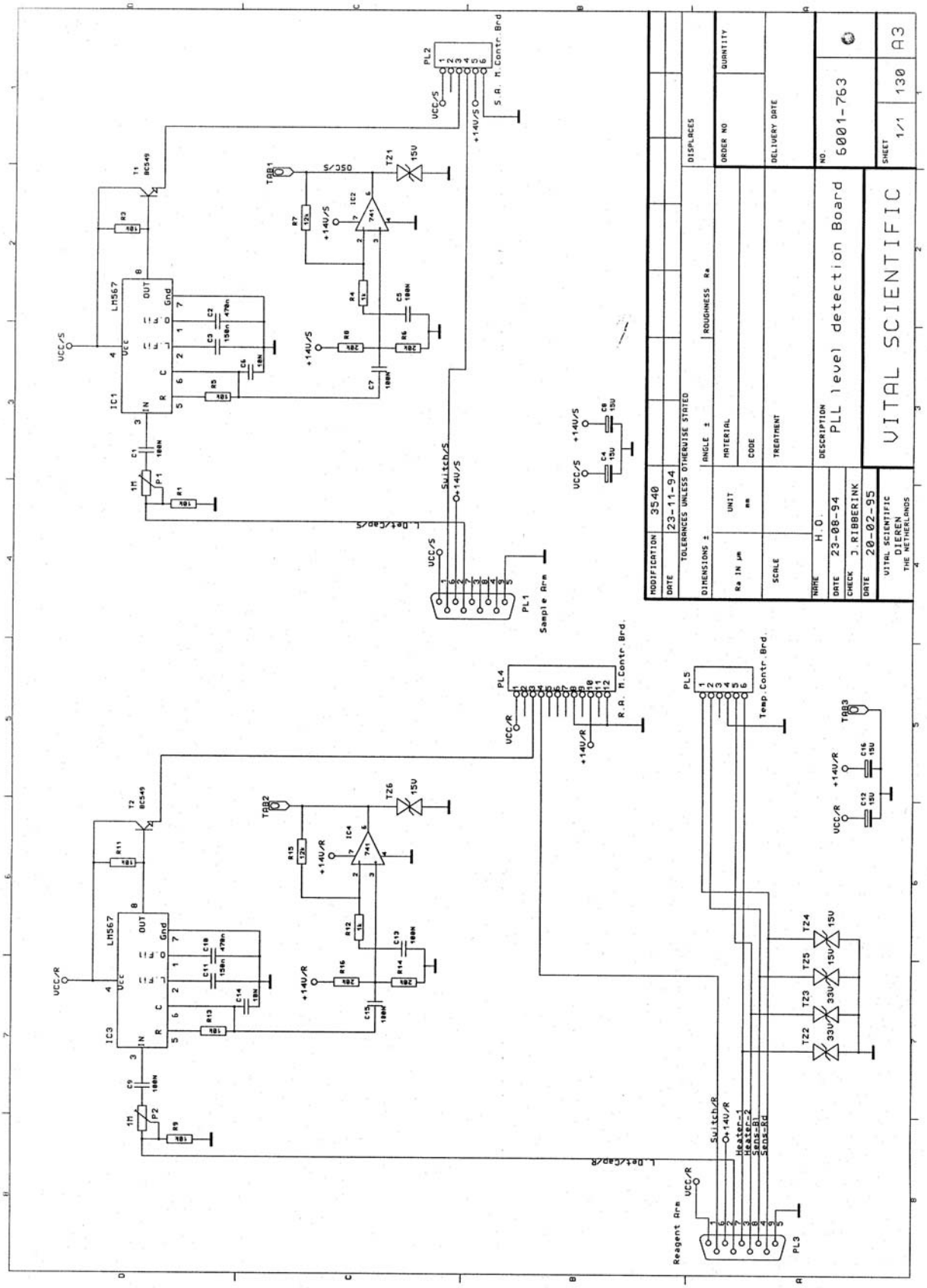

3820-115
3367-036
Comp. zijde
STICKER
3376-341
SYSTEM BRD.
PHOTOM. CELL
LAMP REF. CELL
COVER1
MODIFICATION WIJZIGING 3891 3976 4040 4465
DATE DATUM 951213 960213 960826 000207
TOLERANCES UNLESS OTHERWISE STATED - TOLERANTIES TENZIJ ANDERS VERMELD
DIMENSION MAAT ± | ANGLE HOEK ± | ROUGHNESS RUWHEID R_a
R_a IN µm
UNIT EENHEID mm
SCALE SCHAAL 1:1
MATERIAL MATERIAAL
CODE
TREATMENT BEHANDELING
REPLACES VERVANGT
ORDER NO. ORDER NR.
QUANTITY AANTAL
DELIVERY DATE LEVERDATUM
NAME NAAM R.Rhemdi.
DATE DATUM 94?201
CHECK CONTR. J.Ribbenink
DATE DATUM 950303
DESCRIPTION BENAMING
PHOTOMETER BOARD
NO NR 6001-761
VITAL SCIENTIFIC
VITAL SCIENTIFIC SPANKEREN / DIEREN THE NETHERLANDS
SHEET BLAD 1/1
110
A3


VITAL SCIENTIFIC
PHOTOMETER BOARD
6001-761
23-12-93
20-02-95
J.RIBBERINK
H.O
TOLERANCES UNLESS OTHERWISE STATED
DIMENSIONS ±
ANGLE ±
ROUGHNESS Ra
MATERIAL
TREATMENT
SCALE
DISPLACES
ORDER NO
QUANTITY
DELIVERY DATE
SHEET 1/1 130 A3
VITAL SCIENTIFIC DIEREN THE NETHERLANDS
System Board Conn.
Power Supply
PHOTOR. COAX-CON
LAMP-REF COAX-CON

PLL. BOARD 6001-763

PART NUMBER	DESCRIPTION	LOCATION
3302-401	RES.METAL 1K OHM	R 4,12
3302-501	RES.METAL 10K OHM	R 1,3,5,9,11,13
3302-509	RES.METAL 12K OHM	R 7,15
3302-529	RES.METAL 20K OHM	R 6,8,14,16
3312-261	POTM. ADJ. 1M 0.5W	P 1,2
3315-267	TRANS.VOLTAGE SUPP. 14.5V	TZ 1,4-6
3315-270	TRANSIENT SUPPRES. 33.3V	TZ 2,3
3320-310	CAP. CER. AXIAL 100nF 50V	C 1,5,7,9,13,16
3323-214	CAP. 0.01uF 63V POLY.	C 6,14
3323-321	CAP.POL. 0.15 uF 63VDC+/-20%	C 3,11
3323-350	CAP.P.E 0.47UF 63V	C 2,10
3326-521	CAP.ELC. 15uF 20V	C 4,8,12,16
3331-004	TRANS. BC 549 B	T 1,2
3333-023	IC AD741LN	IC 2,4
3333-513	IC. MONOLITHIC TONE DECODER	IC 1,3
3350-006	CONN.FAST 2.8X0.5	TAB 1-3
3352-014	CONN.6-POLE 826467-6	PL 2,5
3352-082	CONN. 9P HD-20 WITH FILTER	PL 1,3
3353-056	CONN. 2X6 POL. 826469-6	PL 4
3355-002	KEYING PLUG 926498-1	PL 2,4,5
3376-333	PLL. PC.C BOARD	
3820-115	STICKER	

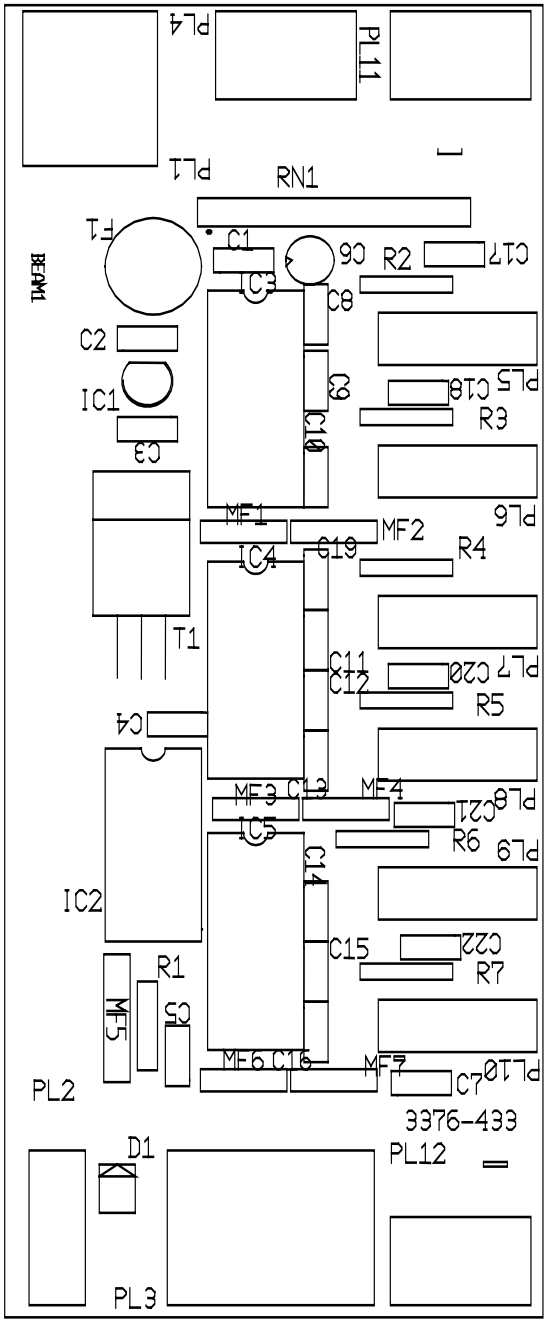


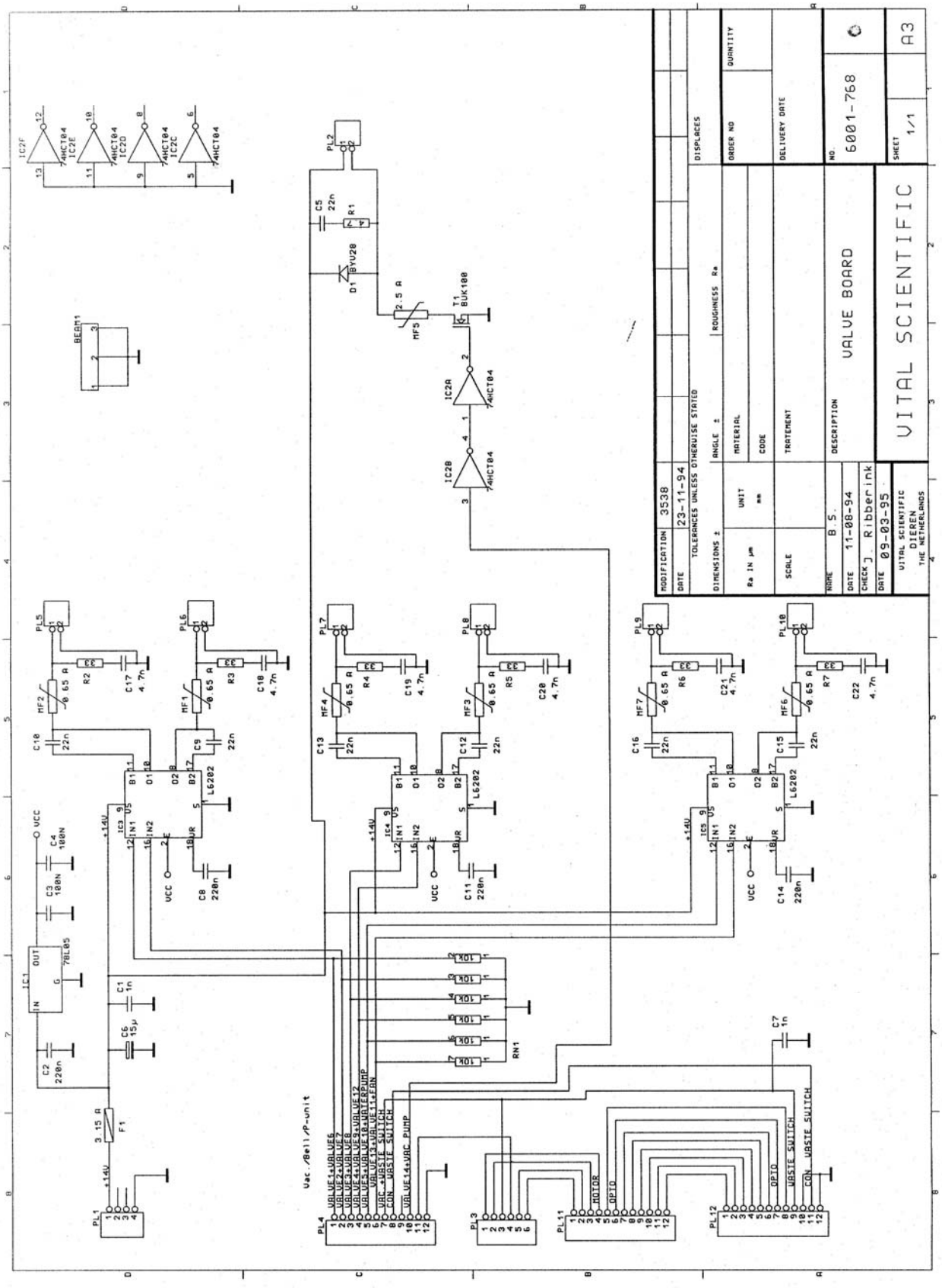

PL2
S.A. M.Contr.Brd
VCC/S
+14U/S
T1
BC549
LM567
IC1
IC2
741
TZ1
15U
TRIM1
OSC/S
Switch/S
Det/Cap/S
PL1
Sample Arm
PL4
R.A. M.Contr.Brd.
VCC/R
+14U/R
T2
IC3
IC4
TZ6
TRIM2
Switch/R
Det/Cap/R
PL5
Temp.Contr.Brd.
TRIM3
TZ4
TZ5
TZ3
TZ2
33U
Heater-1
Heater-2
Sens-Bl
Sens-Rd
Reagent Arm
PL3
MODIFICATION 3540
DATE 23-11-94
TOLERANCES UNLESS OTHERWISE STATED
DIMENSIONS ± ANGLE ± ROUGHNESS Ra
Ra IN µm UNIT mm
MATERIAL
CODE
TREATMENT
DISPLACES
ORDER NO
QUANTITY
DELIVERY DATE
NAME H.O
DATE 23-08-94
CHECK J.RIBBERINK
DATE 20-02-95
DESCRIPTION PLL level detection Board
NO. 6001-763
SHEET 1/1 130 A3
VITAL SCIENTIFIC
VITAL SCIENTIFIC DIEREN THE NETHERLANDS

VALVE BOARD 6001-768

PART NUMBER	DESCRIPTION	LOCATION
3002-016	SCREW ST.ST. M3X6	
3011-011	NUT ST.ST. M3	
3302-120	RES. METAL. 4.7 OHM	R 1
3302-180	RES. METAL 33 OHM 0.6W	R 2-7
3315-037	RES. NETWORK 10 KOHM (10 X)	RN 1
3320-100	CAP.CER. 1NF 40V	C 1,7
3320-150	CAP.CER. 4,7NF 40V	C 17-22
3320-232	CAP.CER 0.022UF 50V	C 5,9,10,12,13,15,16
3320-311	CAP.CER. 0.1uF 50V	C 3,4
3320-312	CAP. CER. 220nF / 63V	C2,8,11,14
3326-521	CAP.ELC. 15uF 20V	C 6
3330-045	DIODE BYV 28-100/100V	D 1
3331-416	PROTECTED POWER MOS-FET	T 1
3333-331	VOLTAGE REGULATOR 5V/100mA	IC 1
3333-545	L 6202 DMOS FULLBRIDGE DR.1,5A	IC 3-5
3335-004	IC 74 HCT 04	IC 2
3348-191	FUSE 3.15A SLOW	F 1
3350-136	CONN.2PM MOD 1 RIGHTANGLE	PL 2,5-10
3351-217	CONN.4-POLE 280616-2	PL 1
3352-012	CONN 280617-2	PL 3
3353-057	CONN. 12POL. 826470-6	PL 4,11,12
3355-002	KEYING PLUG 926498-1	PL 11,12
3366-006	FUSE HOLDER PCB MOUNT.FOR TR5	F 1
3376-432	VALVE BOARD	

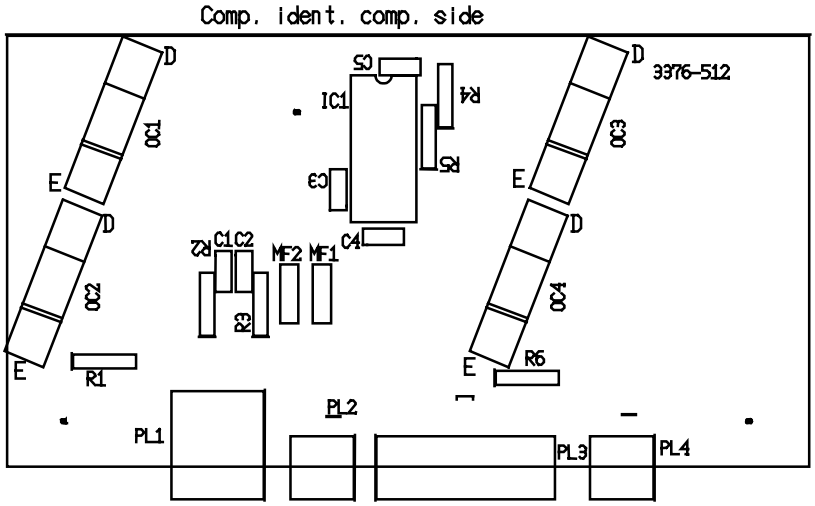
Comp. ident. comp. side

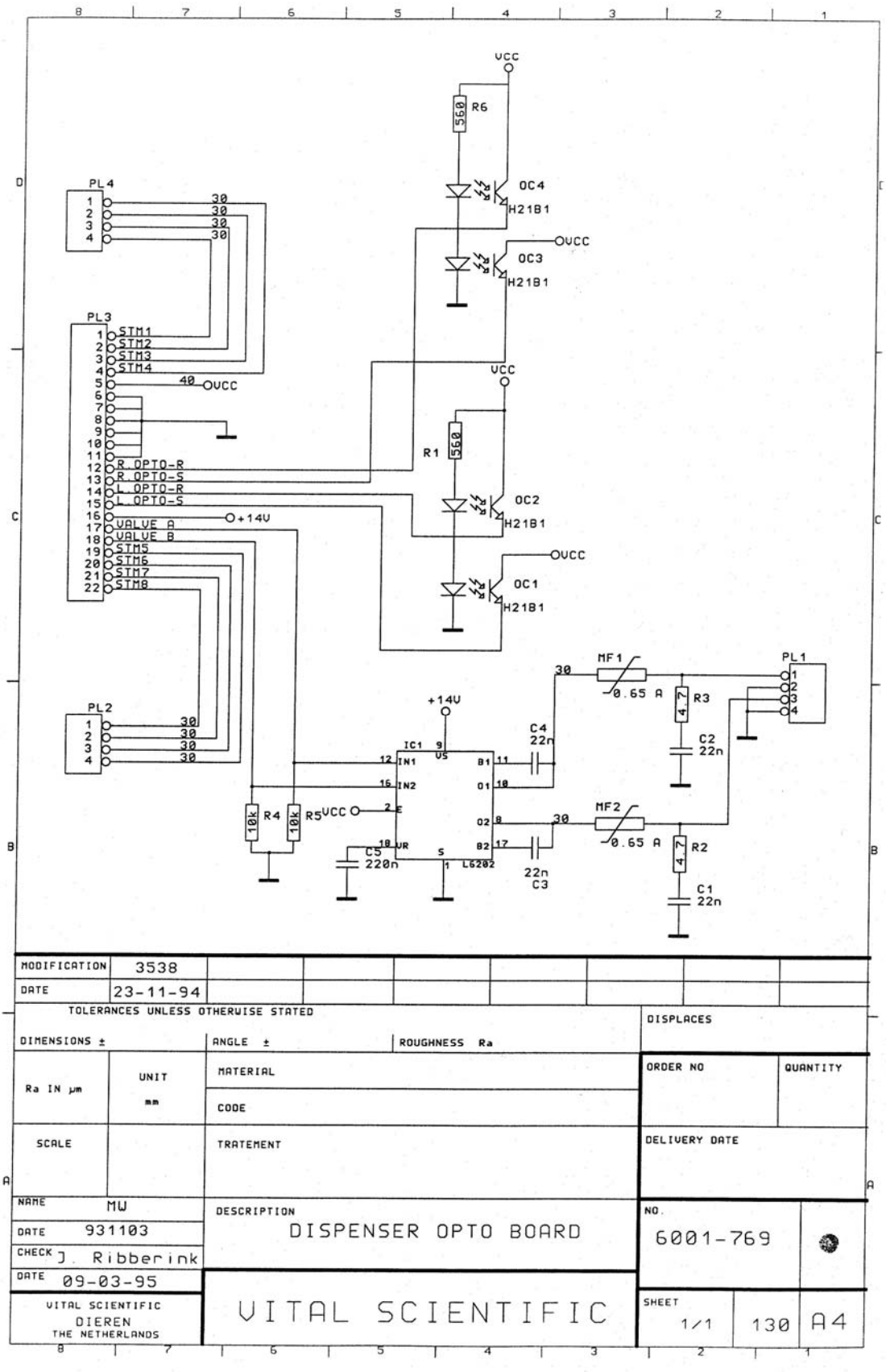



VITAL SCIENTIFIC
VALVE BOARD
6001-768
VITAL SCIENTIFIC
DIEREN
THE NETHERLANDS
Vac./Bell/P-unit

DISPENSER DRIVER BOARD 6001-769

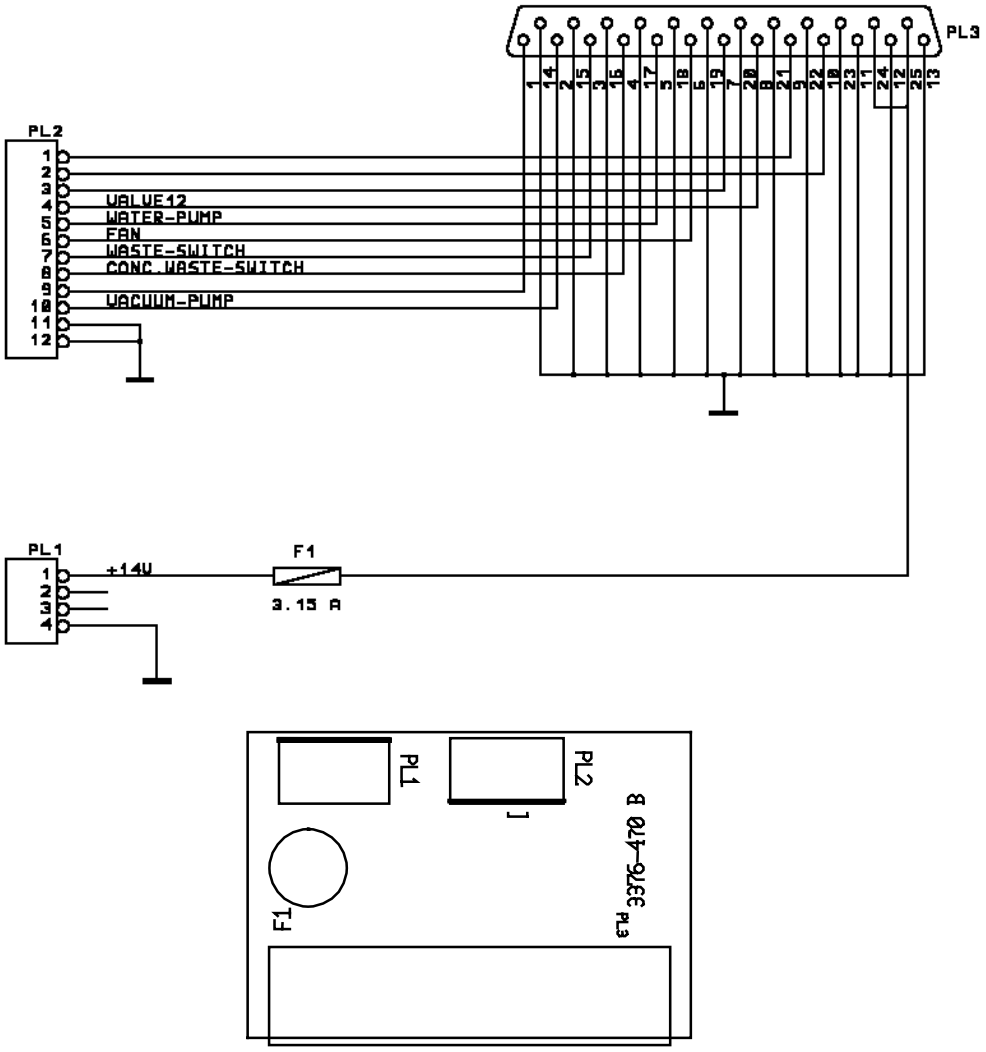
PART NUMBER	DESCRIPTION	LOCATION
3002-016	SCREW ST.ST. M3X6	
3011-011	NUT ST.ST. M3	
3302-120	RES. METAL. 4.7 OHM	R 2,3
3302-373	RES.METAL 560 OHM	R 1,6
3302-501	RES.METAL 10K OHM	R 4,5
3320-232	CAP.CER 0.022UF 50V	C 1-4
3320-312	CAP. CER. 220nF / 63V	C 5
3333-545	L 6202 DMOS FULLBRIDGE DR.1,5A	IC 1
3351-217	CONN.4-POLE 280616-2	PL 1
3351-234	CONN.PLUG 4POL(90°)826468-4	PL 2,4
3353-130	CONN.22PM MOD2 RIGHTANGLE	PL 3
3355-002	KEYING PLUG 926498-1	
3376-511	DISPENSER OPTO BOARD	
3381-053	OPTO INTERRUPTOR H21B1	OC 1-4
3820-115	STICKER	




VCC
R6
560
OC4
H21B1
OC3
H21B1
VCC
PL4
PL3
STM1
STM2
STM3
STM4
VCC
R.OPTO-R
R.OPTO-S
L.OPTO-R
L.OPTO-S
+14U
VALVE A
VALVE B
STM5
STM6
STM7
STM8
R1
560
OC2
H21B1
OC1
H21B1
PL2
MF1
0.65 A
MF2
0.65 A
PL1
R3
4.7
R2
4.7
C4
22n
C2
22n
C3
22n
C1
22n
C5
220n
IC1
L6202
R4
10k
R5
10k
MODIFICATION 3538
DATE 23-11-94
TOLERANCES UNLESS OTHERWISE STATED
DIMENSIONS ±
ANGLE ±
ROUGHNESS Ra
DISPLACES
Ra IN µm
UNIT mm
MATERIAL
CODE
ORDER NO
QUANTITY
SCALE
TRATEMENT
DELIVERY DATE
NAME MW
DATE 931103
CHECK J. Ribberink
DATE 09-03-95
DESCRIPTION
DISPENSER OPTO BOARD
NO. 6001-769
VITAL SCIENTIFIC
DIEREN
THE NETHERLANDS
VITAL SCIENTIFIC
SHEET 1/1
130
A4

CABLE FILTER BOARD 6001-770

PART NUMBER	DESCRIPTION	LOCATION
3348-193	FUSE 4A SLOW	F 1
3351-216	CONN 280610-2	PL 1
3353-056	CONN. 2X6 POL. 826469-6	PL 2
3353-401	CONN.25PF AMPLIMITE HD-20	PL 3
3355-002	KEYING PLUG 926498-1	
3366-006	FUSE HOLDER PCB MOUNT.FOR TR5	F 1
3376-470	CABLEFILTER BOARD	
3820-115	STICKER	

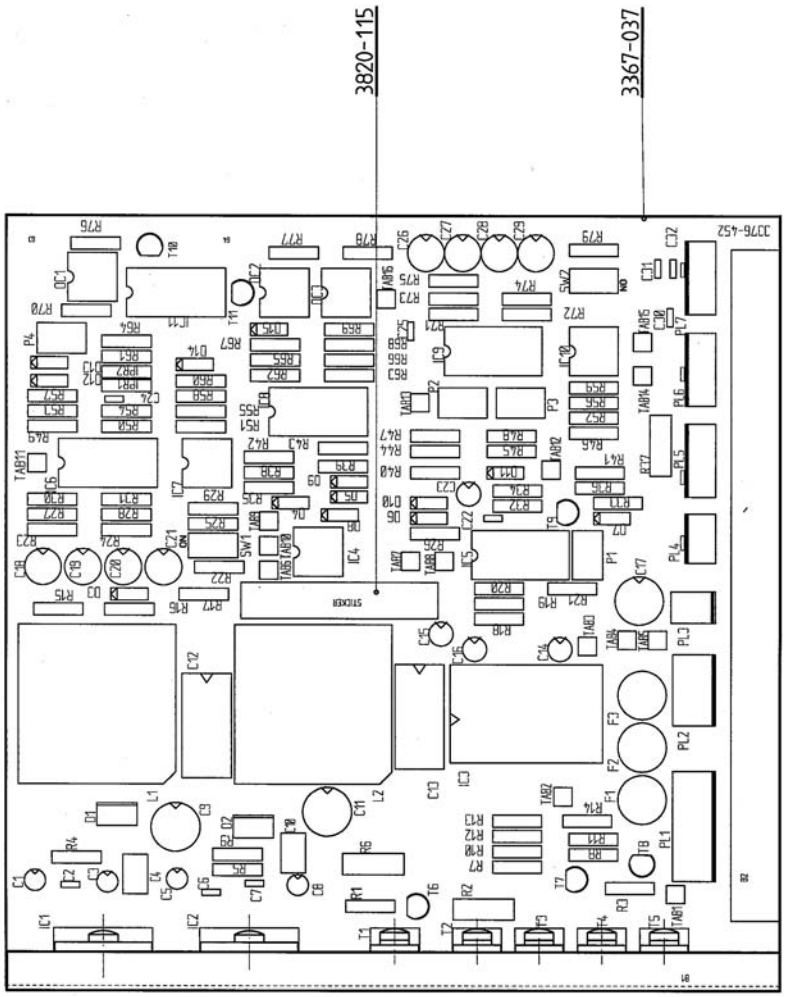


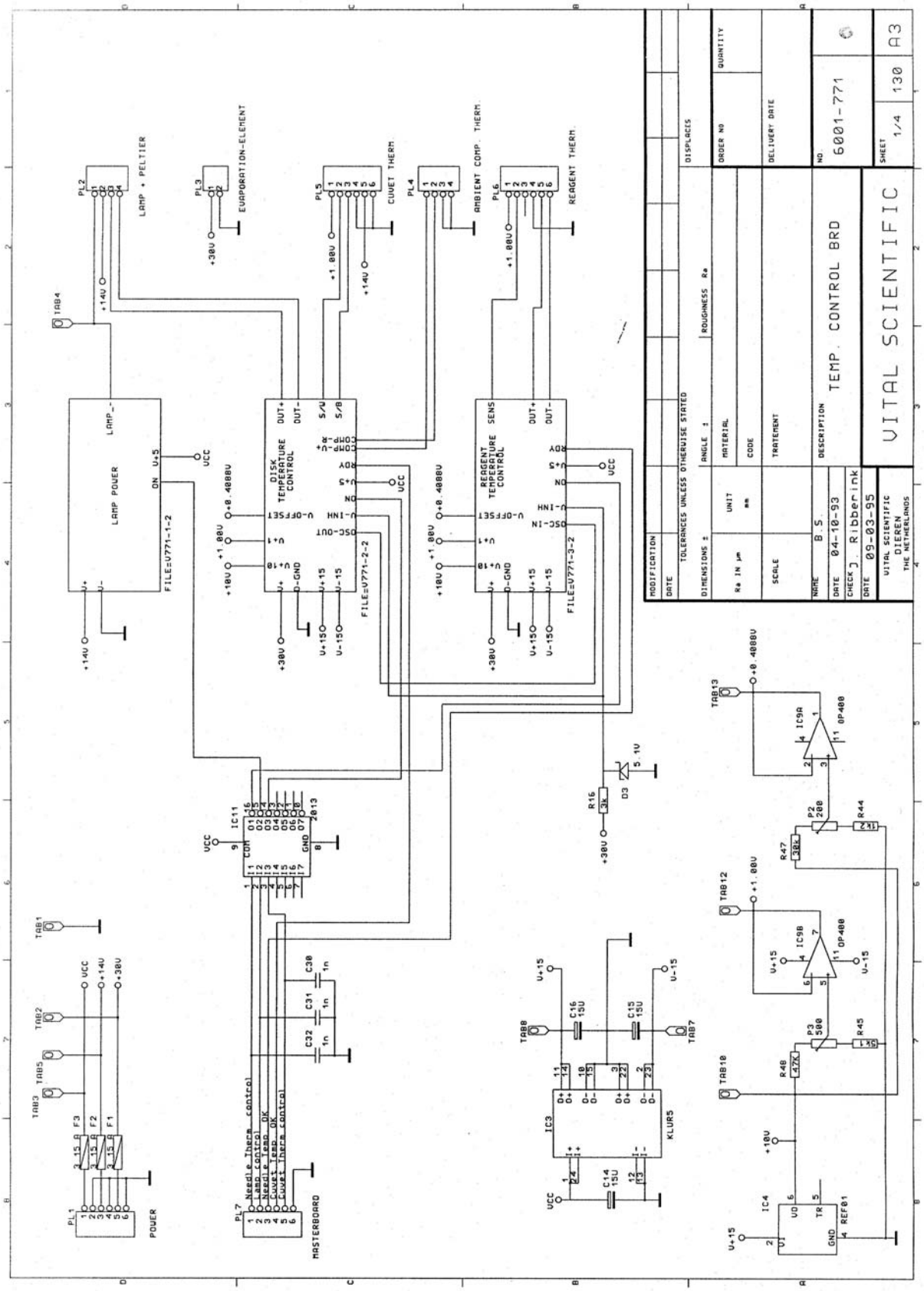
TEMPERATURE BOARD 6001-771

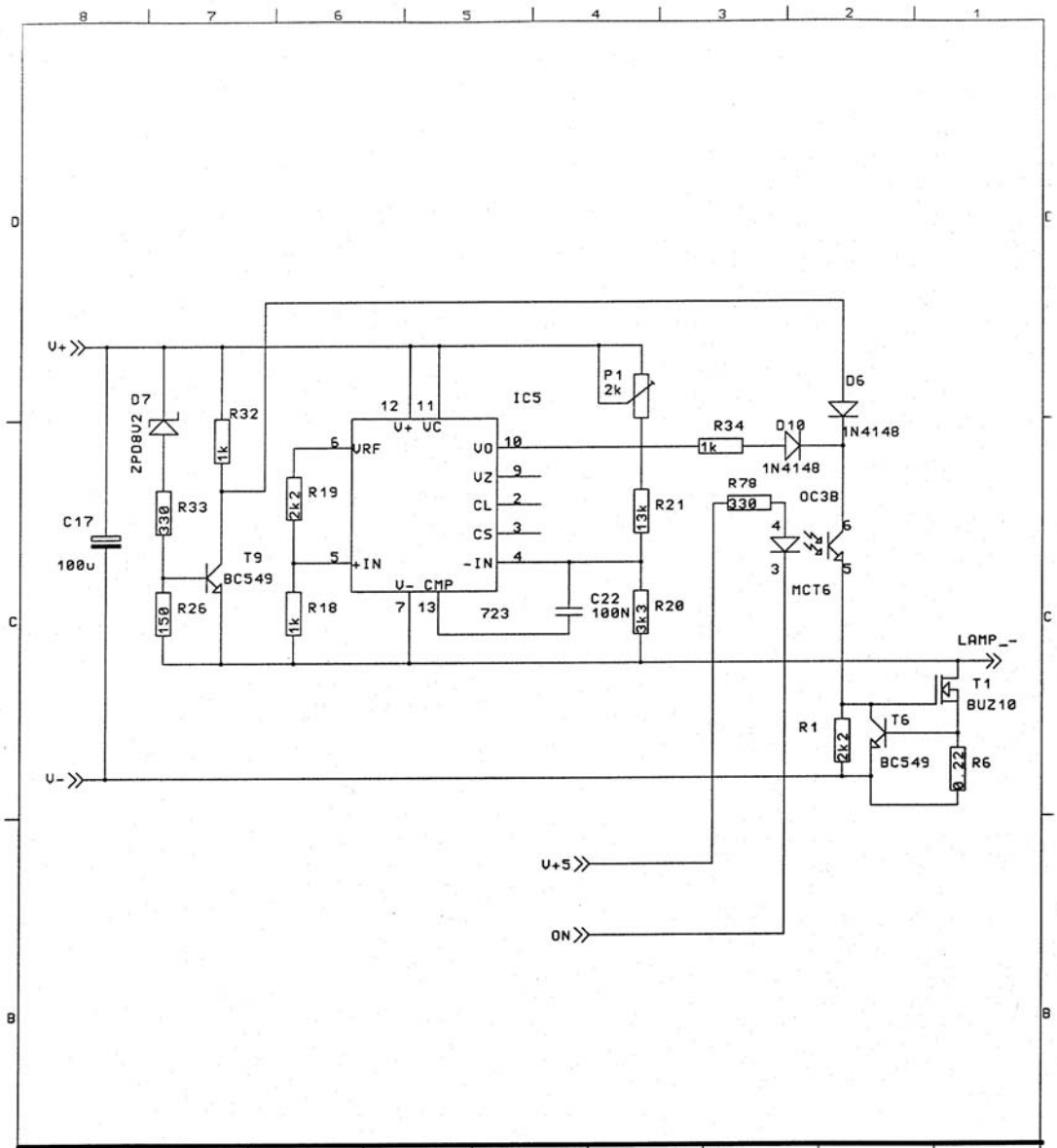
PART NUMBER	DESCRIPTION	LOCATION
3002-018	SCREW ST.ST. M3X8	
3302-285	RES.METAL 75 OHM	R 41
3302-317	RES.METAL 150 OHM	R 26
3302-341	RES.METAL 270 OHM	R 36
3302-349	RES.METAL 330 OHM	R 33,76-78
3302-381	RES.METAL 680 OHM	R 24
3302-401	RES.METAL 1K OHM	R 18,32,34
3302-405	RES.METAL 1K1 OHM	R 66
3302-409	RES.METAL 1K2 OHM	R 44
3302-433	RES.METAL 2K2 OHM	R 1,19
3302-445	RES.METAL 3K OHM	R 16,25,52
3302-449	RES.METAL 3K3 OHM	R 20
3302-465	RES.METAL 4K7 OHM	R 27,55,65,72
3302-469	RES.METAL 5K1 OHM	R 45
3302-473	RES.METAL 5K6 OHM	R 40
3302-481	RES.METAL 6K8 OHM	R 69,70
3302-493	RES.METAL 9K1 OHM	R 61
3302-501	RES.METAL 10K OHM	R 9,11-15,17,R 30,39,43,49, R 50,60,62,67,R 73,74
3302-505	RES. METAL 11K OHM	R 35,57
3302-509	RES.METAL 12K OHM	R 29
3302-513	RES.METAK 13K OHM	R 21,63,64
3302-517	RES.METAL 15K OHM	R 4,5,58,68
3302-529	RES.METAL 20K OHM	R 28,42
3302-545	RES.METAL 30K OHM	R 38,47,53
3302-565	RES.METAL 47K OHM	R 3,7,8,10,48
3302-601	RES.METAL 100K OHM	R 31
3302-665	RES.METAL 470K OHM	R 22,23,75,79
3302-733	RES. METAL 2M2 OHM	R 54,71
3304-032	RES.WW 0.22 OHM	R 2,6,37
3306-474	RES 6K98 OHM	R 59
3306-504	RES 10K1 OHM	R 46
3306-622	RES 215K 25PPM	R 51,56
3312-106	POTM.ADJ. 200 OHM	P 2
3312-108	POTM.ADJ. 500 OHM	P 3
3312-117	POTM.ADJ 2K MT	P 1
3312-132	POTM.ADJ 10K MT	P 4
3320-110	CAP. CER. AXIAL 1 nF 50V	C 6,30-32
3320-233	CAP. CER. AXIAL 22nF 50V	C 2,7,24,25
3320-310	CAP. CER. AXIAL 100nF 50V	C 22
3323-321	CAP.POL. 0.15 uF 63VDC+/-20%	C 4,10
3326-431	CAP.ELC. 2,2 uF	C 1,3,5,8
3326-521	CAP.ELC. 15uF 20V	C 14-16,23
3326-551	CAP.ELC 47UF 20V	C 18-21,26-29
3326-613	CAP.ELC. 100 uF	C 12,13
3326-615	CAP. ELEC. 100 uF 63V	C 9,11,17
3330-010	DIODE IN 4148	D 4-6,8-10,D 12-15
3330-041	DIODE MUR 1610 CT	D 1,2
3330-303	DIODE.ZENER.ZPD 2.7	D 11
3330-308	DIODE.ZENER.ZPD 5.1	D 3
3330-318	DIDOE ZENER 8,2V	D 7
3331-004	TRANS. BC 549 B	T 6-11
3331-415	TRANS.IRFZ 20	T 1-5
3333-018	IC.OP 07EP	IC 7,10
3333-019	IC-OP400 QUAD OP.AMPLIFIER	IC 9

3333-028	IC.LM 324N	IC 6,8

PART NUMBER	DESCRIPTION	LOCATION
3333-311	IC uA 723PC	IC 5
3333-316	IC L296	IC 1,2
3333-323	IC REF-01 HP	IC 4
3333-518	IC ULN2013A	IC 11
3342-311	SWITCH SLIDE 0-161390-1	SW 1,2
3348-191	FUSE 3.15A SLOW	F 1-3
3350-006	CONN.FAST 2.8X0.5	TAB 1-16
3350-137	CONN. 2POL. 280609-2	PL 3
3350-146	CONN. 8136-650P2	J 2
3351-216	CONN 280610-2	PL 2
3351-235	CONN. 4POL 826467-4	PL 4
3352-011	CONN 280611-2	PL 1
3352-014	CONN.6-POLE 826467-6	PL 5-7
3355-002	KEYING PLUG 926498-1	PL 4-7
3359-002	POWER UNIT DC CONVERTOR	IC 3
3362-622	COIL ZKB 422/061	L 1,2
3366-006	FUSE HOLDER PCB MOUNT.FOR TR5	F 1-3
3370-109	MOUNT.SET.TO-220	T 1-5
3376-452	TEMPERATURE BOARD	
3381-071	OPTOCOUPLER.MCT 6	OC 1-3
3820-115	STICKER	
4502-353	BEAM	A3




LAMP + PELTIER
EVAPORATION-ELEMENT
CUVET THERM.
AMBIENT COMP. THERM.
REAGENT THERM.
LAMP POWER
DISK TEMPERATURE CONTROL
REAGENT TEMPERATURE CONTROL
FILE=V771-1-2
FILE=V771-2-2
FILE=V771-3-2
TEMP. CONTROL BRD
VITAL SCIENTIFIC
6001-771
POWER
MASTERBOARD
KLUR5
REF01
OP400



MODIFICATION									
DATE									

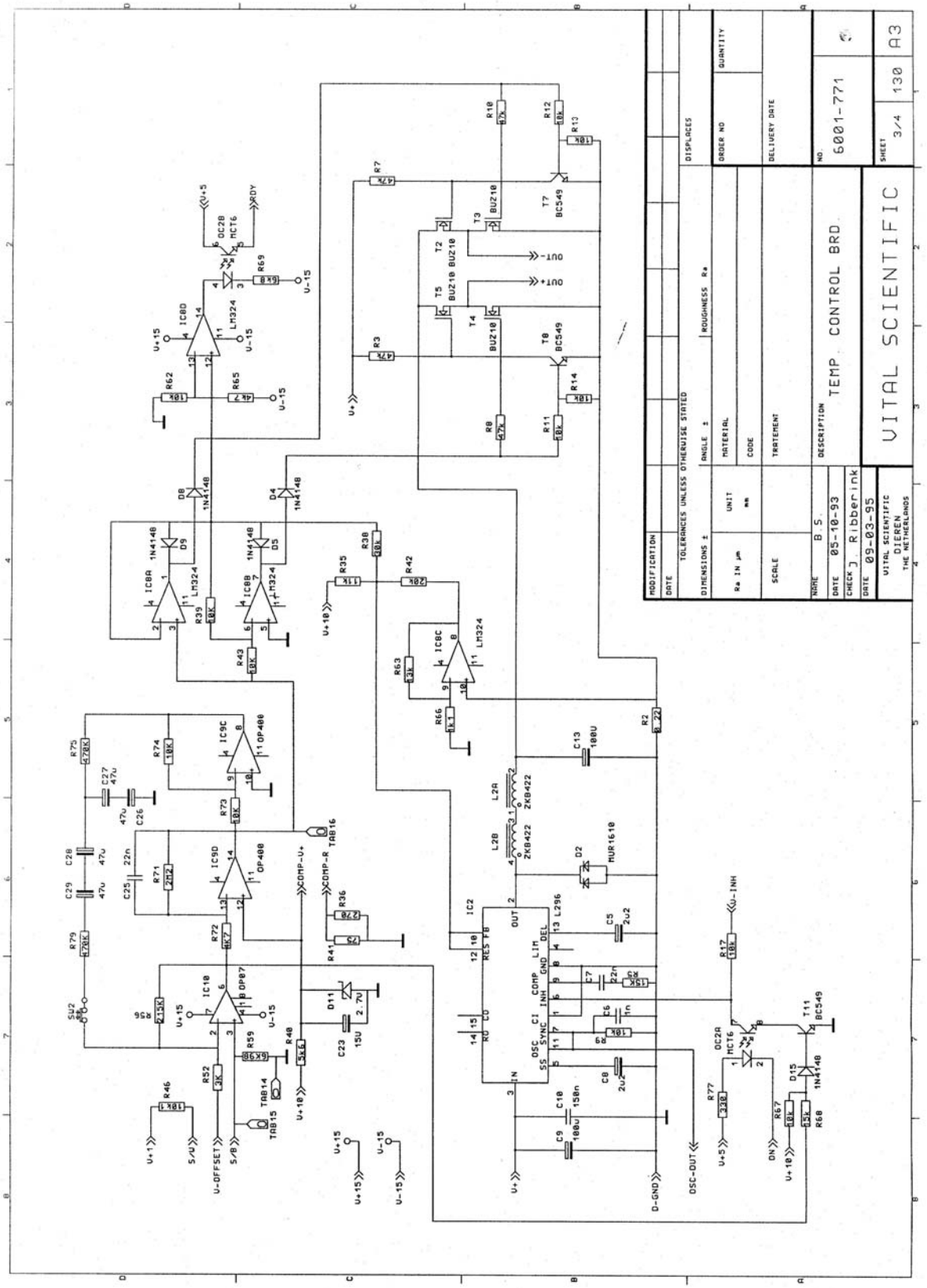
TOLERANCES UNLESS OTHERWISE STATED

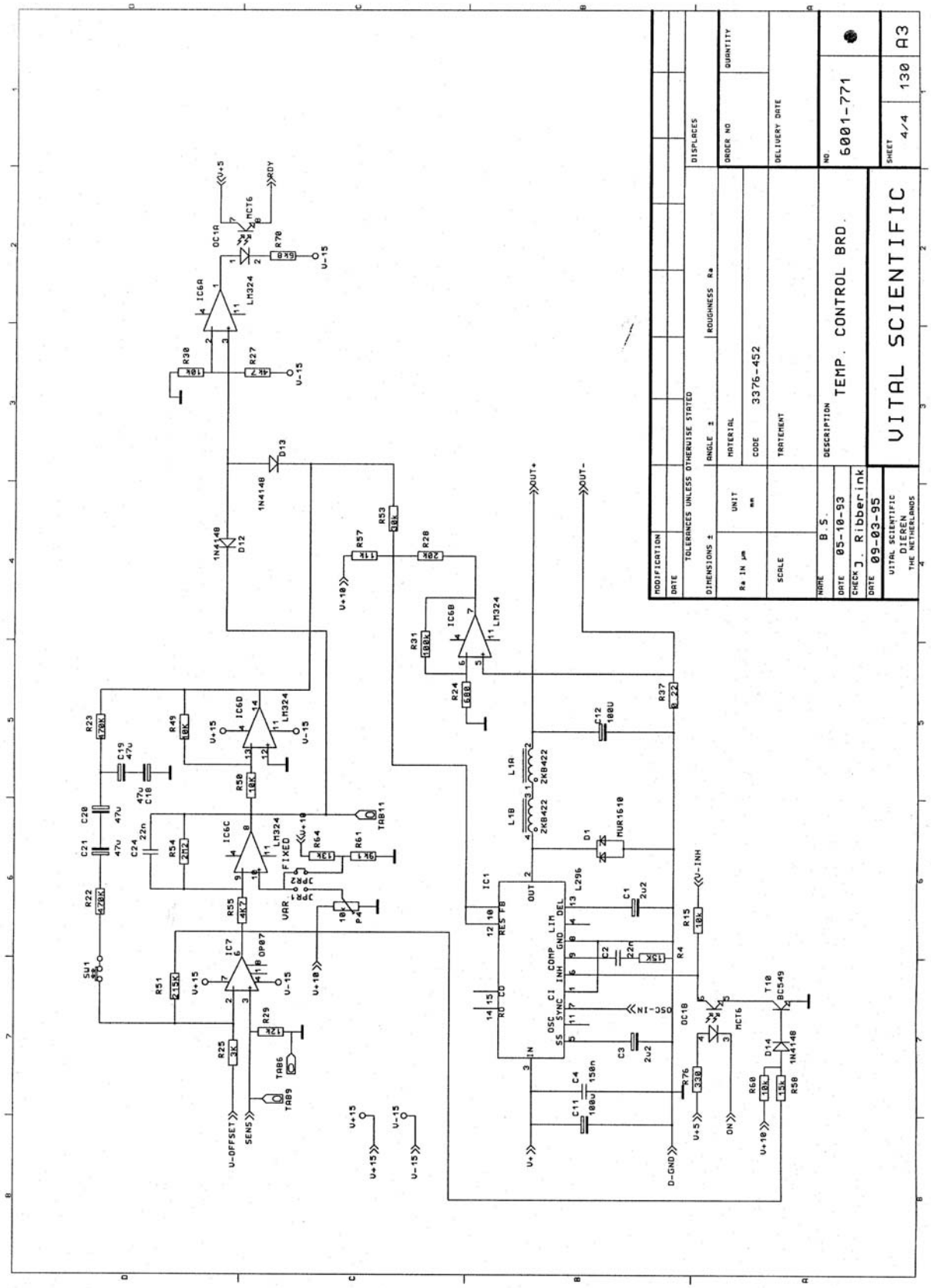
DISPLACES

DIMENSIONS ±	ANGLE ±	ROUGHNESS Ra

Ra IN µm	UNIT mm	MATERIAL	ORDER NO	QUANTITY
		CODE		
SCALE		TRATEMENT	DELIVERY DATE	

NAME B.S.	DESCRIPTION TEMP. CONTROL BRD.	NO. 6001-771	
DATE 05-10-93			
CHECK J. Ribberink			
DATE 09-03-95			
VITAL SCIENTIFIC DIEREN THE NETHERLANDS	VITAL SCIENTIFIC	SHEET 2/4	130 A4


VITAL SCIENTIFIC
TEMP CONTROL BRD
6001-771
VITAL SCIENTIFIC
DIEREN
THE NETHERLANDS
05-10-93
09-03-95
J. Ribberink
U+
U-
D-GND
OSC-OUT
U-INH
COMP-U+
COMP-R
U-OFFSET
OUT+
OUT-


VITAL SCIENTIFIC
TEMP. CONTROL BRD.
6001-771
3376-452
05-10-93
09-03-95
J. Ribberink
B.S.
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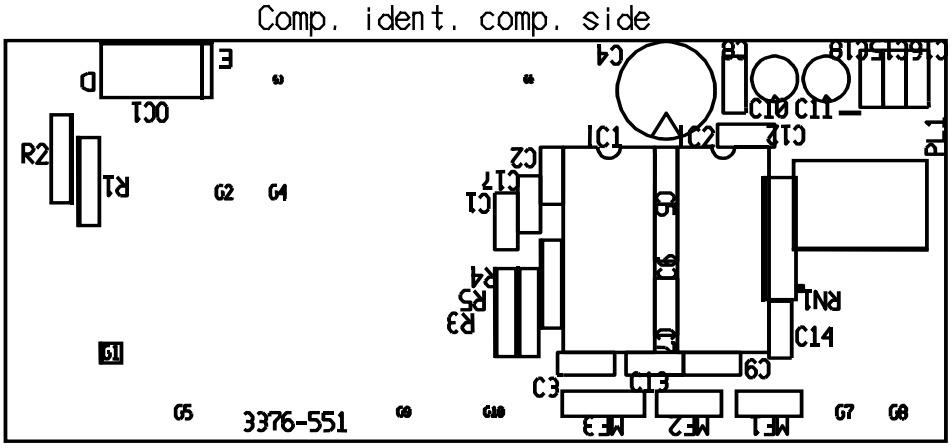
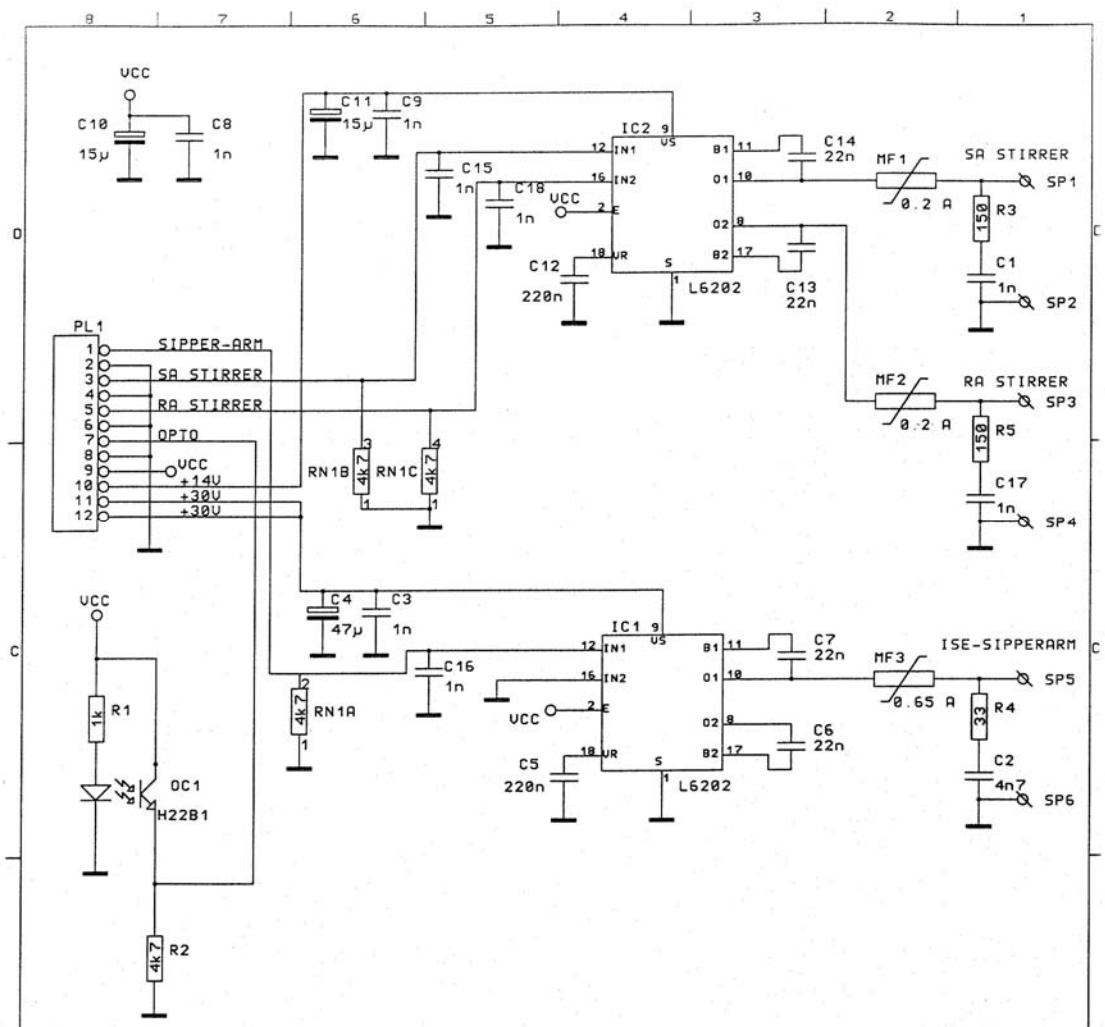
130
A3
IC6A
IC6B
IC6C
IC6D
IC7
IC1
LM324
OP07
L296
MCT6
BC549
1N4148
MUR1610
U+5
U+10
U+15
U-15
U-INH
OSC-IN
D-GND
U-OFFSET
SENS
ON
VAR. FIXED

ISE-SIPPER / STIRRER DRIVER BOARD 6001-773

PART NUMBER	DESCRIPTION	LOCATION
3302-180	RES. METAL 33 OHM 0.6W	R 4
3302-317	RES.METAL 150 OHM	R 3,5
3302-401	RES.METAL 1K OHM	R 1
3302-465	RES.METAL 4K7 OHM	R 2
3315-009	RES.N.W. 4X4K7	RN 1
3320-100	CAP.CER. 1NF 40V	C1,3,8,9,15,16-18
3320-150	CAP.CER. 4,7NF 40V	C2
3320-232	CAP.CER 0.022UF 50V	C6,7,13,14
3320-312	CAP. CER. 220nF / 63V	C5,12
3326-521	CAP.ELC. 15uF 20V	C10,11
3326-554	CAP.ELC. 47uF / 63V	C4
3333-545	L 6202 DMOS FULLBRIDGE DR.1,5A	IC1,2
3353-057	CONN. 12POL. 826470-6	PL1
3355-002	KEYING PLUG 926498-1	PL1
3376-550	ISE SIP./STIR. DRIVER BRD	
3381-052	OPT.SWITCH H22B1	OC1
3820-115	STICKER	





MODIFICATION	3538								
DATE	23-11-94								

TOLERANCES UNLESS OTHERWISE STATED

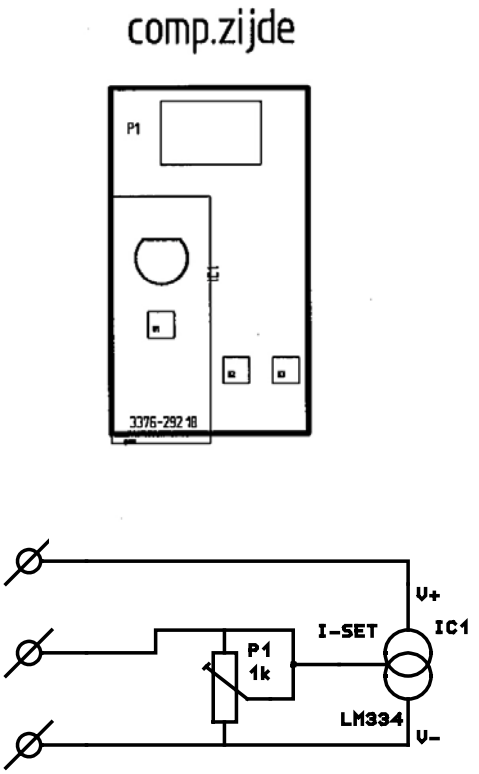
DISPLACES

DIMENSIONS ±	ANGLE ±	ROUGHNESS Ra	ORDER NO	QUANTITY
Ra IN µm / UNIT mm	MATERIAL			
	CODE			
SCALE	TREATMENT		DELIVERY DATE	

NAME GK	DESCRIPTION	NO.	
DATE 30-03-94	ISE SIPPER\STIRRER DRIVER BOARD	6001-773	
CHECK J. Ribberink			
DATE 09-03-95			
VITAL SCIENTIFIC DIEREN THE NETHERLANDS	VITAL SCIENTIFIC	SHEET 1/1	130 A4

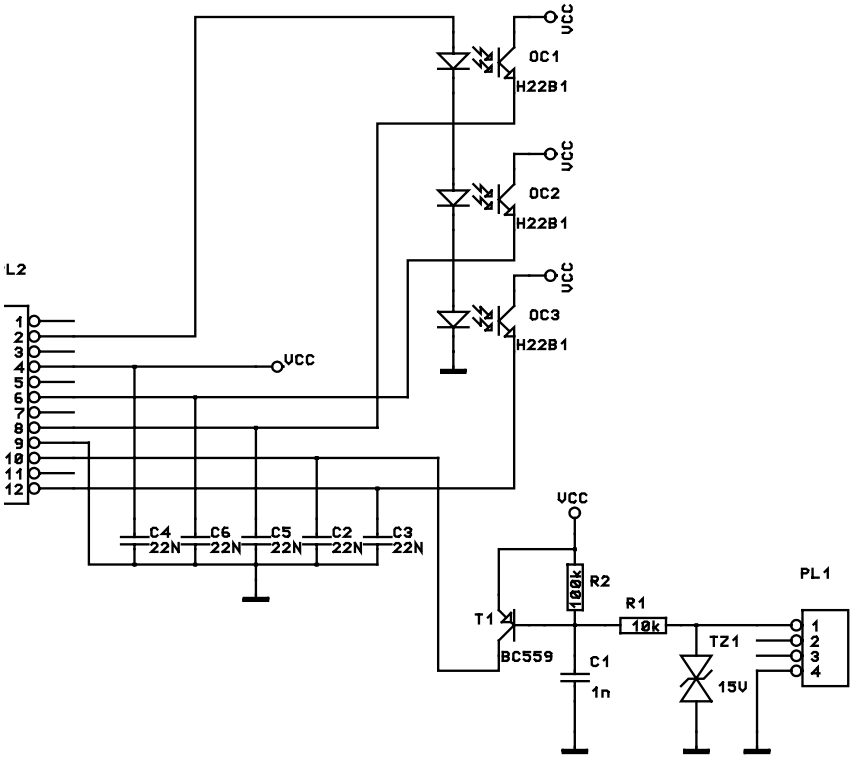
TEMP. COMP. BOARD ASSEMBLY A3 6001-858

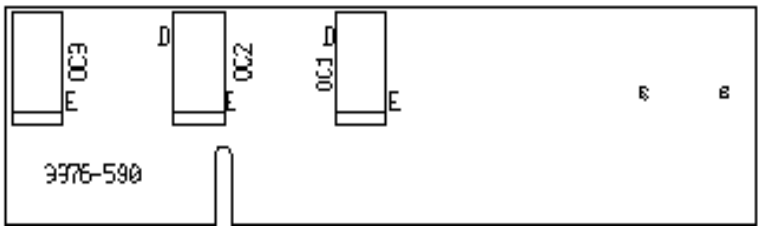
PART NUMBER	DESCRIPTION	LOCATION
3002-016	SCREW ST.ST. M3X6	
3312-112	POTM.ADJ 1K MT	P 1
3333-431	IC LM 334Z	IC 1
3350-039	CONN.167301-4	
3351-236	CONN.HOUSING 4PF 926475-4	
3355-004	RETENTION PLUG 926477-1	
3370-008	SLEEVE CABLE H30X20BL	
3370-430	CLIPCABLE TIE INSULOK T18R-W	
3372-010	WIRE 0.15 BLACK	
3372-645	CABLE SCR. 4 X 0.14	
3376-292	TEMP. COMP. PC.BOARD	A4
4501-495	BLOCK	A4



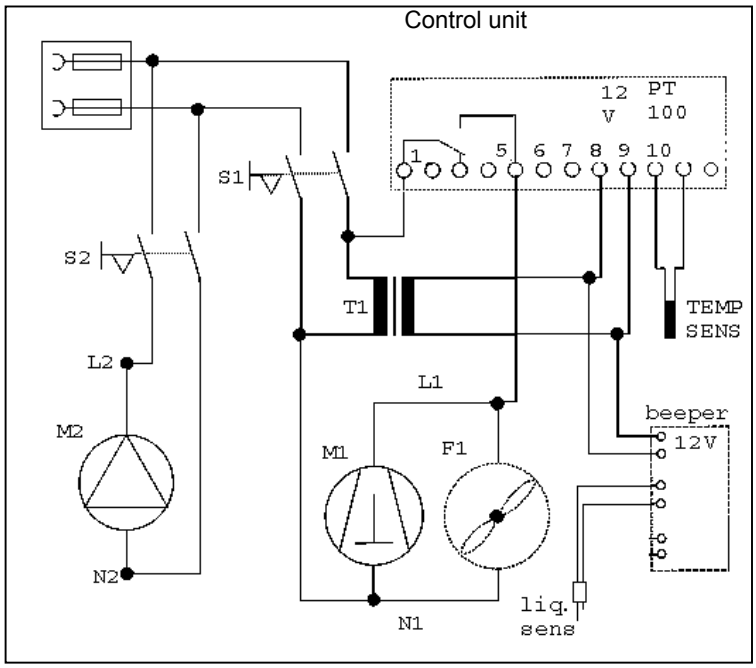
WASH ARM BOARD 6001-882

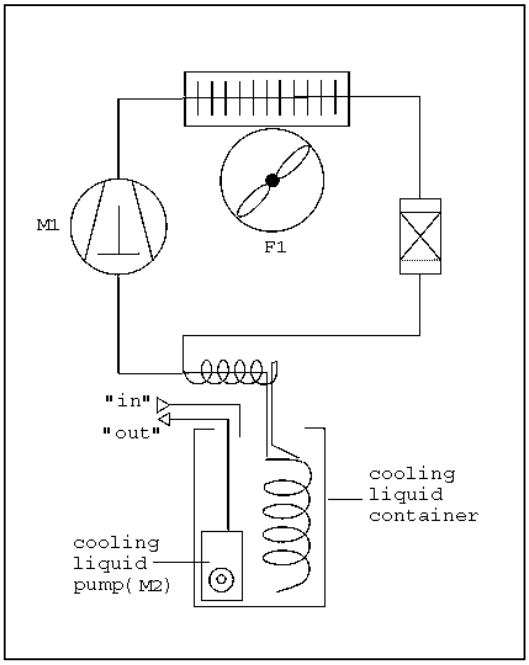
PART NUMBER	DESCRIPTION	LOCATION
3302-501	RES.METAL 10K OHM	R 1
3302-601	RES.METAL 100K OHM	R 2
3315-267	TRANS.VOLTAGE SUPP. 14.5V	TZ 1
3320-100	CAP.CER. 1NF 40V	C 1
3320-232	CAP.CER 0.022UF 50V	C 2-6
3331-214	TRANS.BC 559B	T 1
3351-235	CONN. 4POL 826467-4	PL 2
3353-056	CONN. 2X6 POL. 826469-6	PL 1
3355-002	KEYING PLUG 926498-1	
3376-590	WASH ARM PC. BOARD	A4
3381-052	OPT.SWITCH H22B1	OC 1-3
3820-115	STICKER	





Cooling unit diagrams.





9 MECHANICAL DRAWINGS

9.1 INTRODUCTION

This section contains all the relevant exploded view drawings of the analyser.

Page	Unit	
2	main units	
4	assembly of covers	
6	tubing diagram	
8	tube connector plate assembly collecting casks	
10	assembly of main units for water and vacuum system	
12	water cask waste tubes connection block assembly vacuum tube	
14	bellows pump	
16	external pump unit	
18	main electrical units	
20	mechanical assembly	
26	sample / reagent arm:	- swing unit - clamp assy - carriage assy - encoder opto unit - encoder stepper motor
28	stirrer unit (ise arm option)	
30	sample / reagent rotor unit	
32	wash arm:	- movement assembly - up/down stepper motor - wash arm - adjust block assembly
34	Measuring unit (optical block):	- main assembly - encoder stepper motor unit - encoder opto unit - lamp holder mounting plate assembly - lamp holder unit - filterwheel with filters - beam splitter
40	pipettor unit	
42	valve drive unit	
44	heat exchanger reagent rotor	
46	water container waste containers	

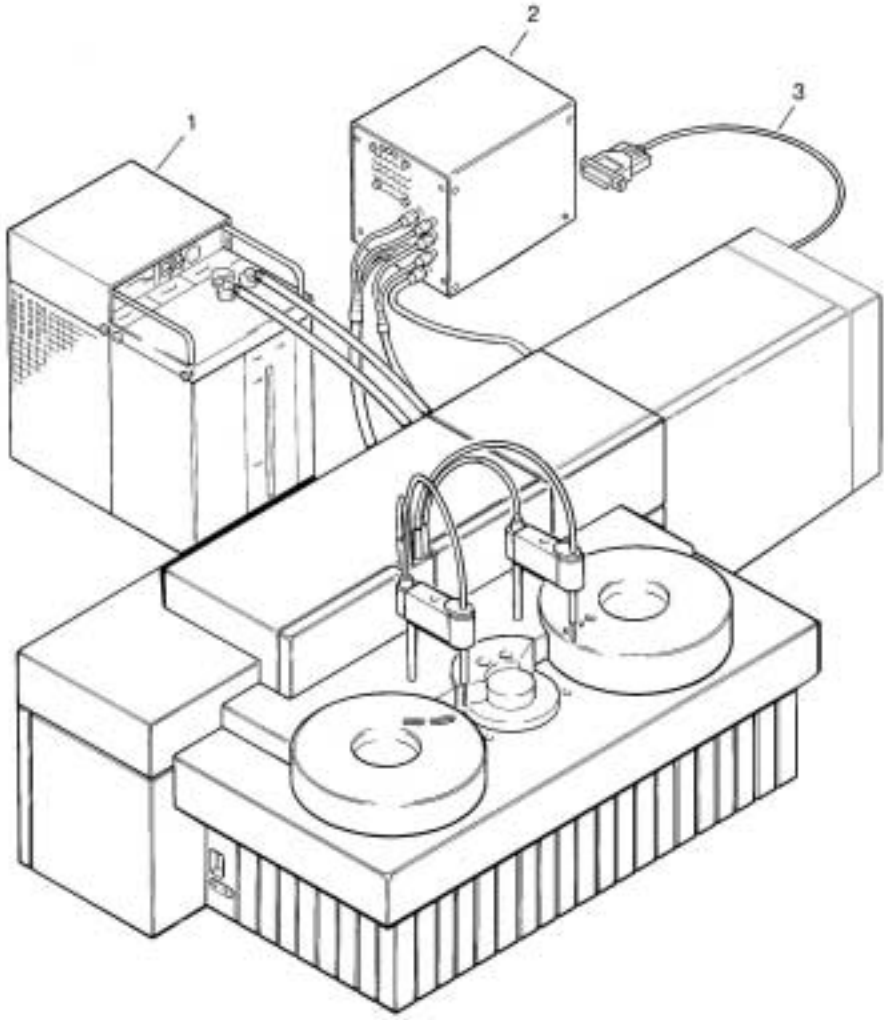
SPARE PARTS

Page	Unit
48	Power supply Cooling unit
49	Sample / reagent arm

MAIN UNITS

PART NUMBER	DESCRIPTION	LOCATION
6001-956	COOLING UNIT 220V / 50Hz	1
6001-959	COOLING UNIT 110V / 60Hz	
6001-753	EXTERNAL PUMP UNIT	2
3374-059	PUMPUNIT CABLE	3

MAIN UNITS

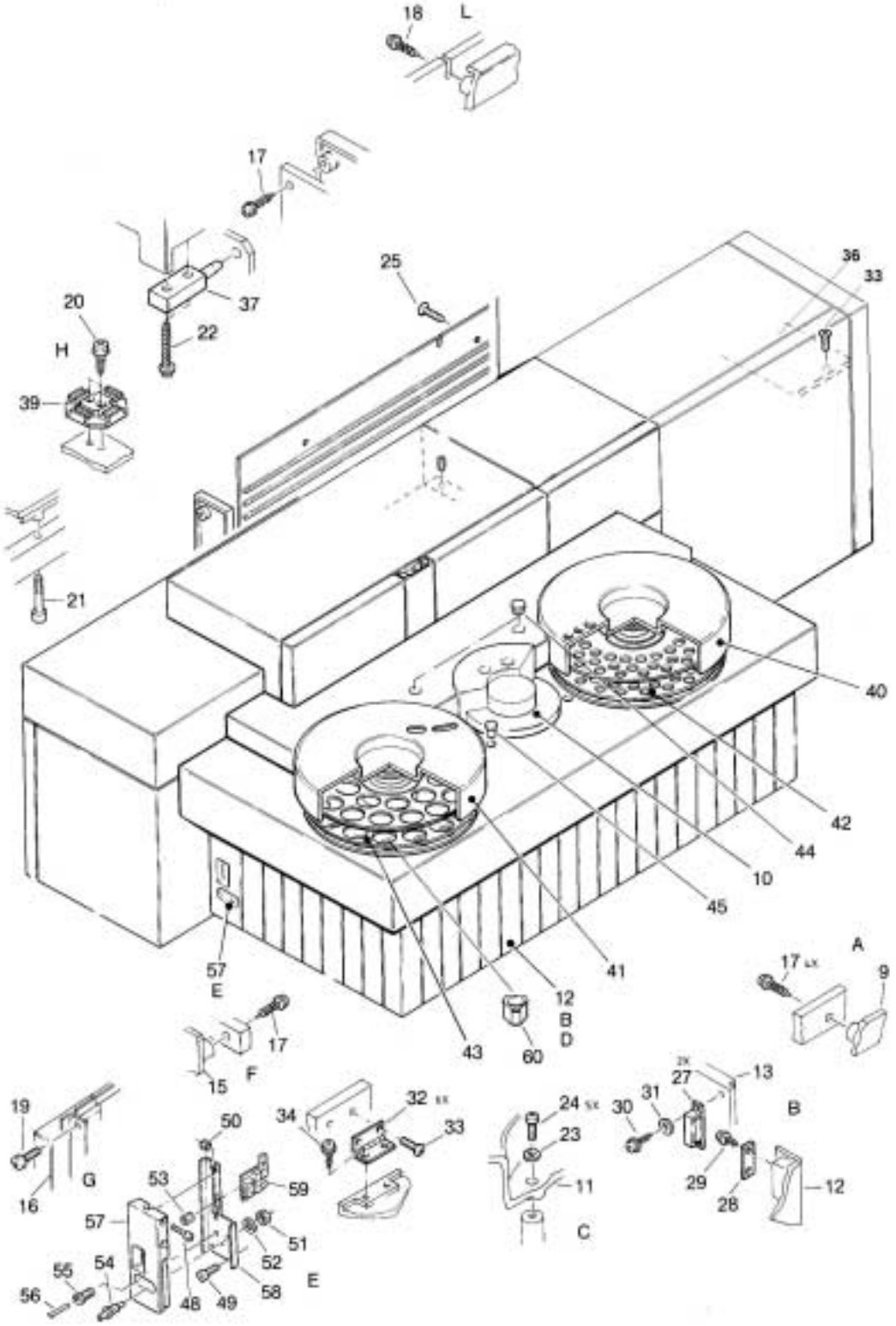


ASSEMBLY OF COVERS

PART NUMBER	DESCRIPTION	LOCATION
6001-833	COVER CUVETTE ROTOR	10
3002-231	SCREW PLASTITE M4X12	17
3002-232	SCREW PLASTITE M4X16	18
3002-016	SCREW M3X6	19
3002-313	SCREW M3X16	20
3008-040	SCREW M4X5	21
3002-233	SCREW PLASTITE M4X30	22
3002-022	WASHER	23
3002-029	SCREW M4X16	24
3002-228	SCREW PLASTITE M3X16	25
3055-008	MAGNET STRIP	27
4802-269	PLATE	28
3002-224	SCREW PLASTITE M3X8	29
3002-227	SCREW PLASTITE M3X12	30
3022-010	WASHER 3.2	31
3070-347	HINGE	32
3004-210	SCREW M3X6	33
3002-026	SCREW M3X6	38
4803-318	TUBE PLATE	39
3070-343	SAMPLE COVER	40
3070-351	REAGENT COVER	41
6001-957	SAMPLE ROTOR	42
6001-784	REAGENT ROTOR	43
4107-051	FIXING SCREW	43A
4100-476	BUSH	. 44
4100-210	BUSH	45
3002-318	SCREW M3X25	48
3002-329	SCREW M4X8	49
3019-011	NUT INSERT	50
3019-027	NUT M6X075	51
3022-025	WASHER	52 *
3370-525	SCREWLOCK FEMALE	53 *
4100-656	CONNECTOR	54 *
4100-657	CONNECTOR	55 *
4104-102	PIPE	56 *
4501-523	PANEL	57 *
4803-452	BRACKET	58 *
6001-767	ISE INTERFACE BOARD	59 *
4100-555	ADAPTOR	60 *

* = ONLY WHEN ISE OPTION INSTALLED

ASSEMBLY OF COVERS



TUBING DIAGRAM

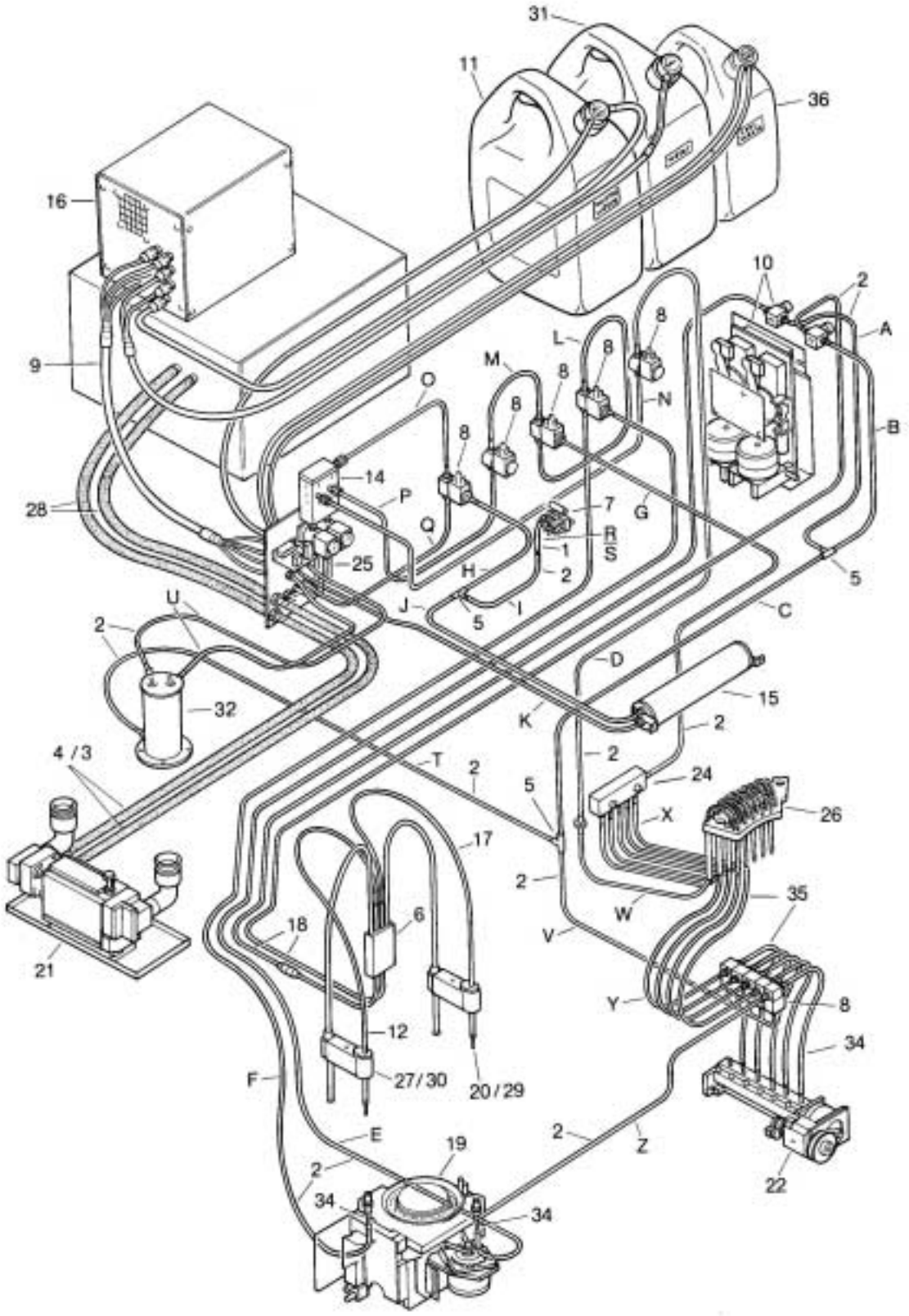
Length and position of tubing may be different from the drawing because of changes in the design!

PART NUMBER	DESCRIPTION	LOCATION
1513-051 *	TUBE PVC 4X6	1
1513-050 *	TUBE PVC 2X4	2
6001-877	TUBE ASSY	3
6001-877	TUBE ASSY	4
3066-050	T-CONNECTOR	5
3070-338	COVER	6
3344-004	VACUUM DETECTOR	7
3366-920	ASCO VALVE 3-WAY	8
6001-861	TUBING SET FOR WATER/VACUUM	9
6001-754	PIPETTOR UNIT	10
6001-826	DILUTED WASTE CONTAINER	11
6001-405	TUBING ASSY REAGENT PROBE	12
6001-788	COLLECTING CASK	14
6001-423	VACUUM TUBE	15
6001-753	EXTERNAL PUMP UNIT	16
6001-428	TUBING SET FOR SAMPLE	17
6001-431	TUBING ASSY PIPETTOR UNIT	18
6001-756	MEASURING UNIT	19
6001-801	SAMPLE HEAD ASSY	20
6001-797	HEAT EXCHANGER REAGENT ROTOR	21
6001-839	BELLOWS PUMP	22
6002-172	CONNECTION BLOCK ASSEMBLY	24
6001-787	CONNECTOR PLATE ASSEMBLY	25
6001-961	WASH ARM	26
6001-872	TUBE ASSEMBLY	28
6001-860	WATER CONTAINER	31
6001-786	WATER CASK	32
1513-052 *	TUBE PVC 1.5X3.5	34
1513-053 *	TUBE PVC 1.5X2.5	35
6001-827	CONCENTRATED WASTE CONTAINER	36

Remark * is only available in length of 5 mtr.

TUBE	FROM	TO	CODE NO:	LENGTH
A	VALVE SAMPLE DISPENSER	T-CONNECTOR (3066-050)	1513-001	260mm
B	VALVE REAGENT DISPENSER	T-CONNECTOR (3066-050)	1513-001	240mm
C	T-CONNECTOR (3066-050)	T-CONNECTOR (3066-050)	1513-001	550mm
D	VALVE 14 / GATE 2	SOCKET (3066-088)	1513-001	700mm
E	VALVE 5 / GATE 1	WASHPLACE REAGENT	1513-001	1100mm
F	VALVE 5 / GATE 3	WASHPLACE SAMPLE	1513-001	800mm
G	VALVE 4 / GATE 3	CONNECTION BLOCK ASSY	1513-001	450mm
H	VALVE 1 / GATE 3	T-CONNECTOR (3066-050)	1513-001	160mm
I	T-CONNECTOR (3066-050)	SOCKET (3066-087)	1513-001	100mm
J	T-CONNECTOR (3066-050)	VACUUM TUBE (UPPER)	1513-001	120mm
K	VACUUM TUBE (LOWER)	CONN. PLATE ASSY (CONN 2)	1513-001	350mm
L	VALVE 5 / GATE 2	VALVE 4 / GATE 1	1513-001	200mm
M	VALVE 4 / GATE 2	VALVE 2 / GATE 2	1513-001	60mm
N	VALVE 14 / GATE 1	COLLECTING CASK	1513-001	360mm
O	VALVE 1 / GATE 2	COLLECTING CASK	1513-001	140mm
P	VALVE 2 / GATE 1	COLLECTING CASK	1513-001	240mm
Q	VALVE 1 / GATE 1	CONN. PLATE ASSY (CONN 3)	1513-001	370mm
R	VACUUMSWITCH	ELBOW (3066-092)	1513-002	40mm
S	ELBOW (3066-092)	SOCKET (3066-087)	1513-001	40mm
T	T-CONNECTOR (3066-050)	WATER CASK (LOWER)	1513-001	110mm
U	WATER CASK (UPPER) 2X	CONN. PLATE ASSY (CONN 1 AND 4)	1513-001	160mm
V	T-CONNECTOR (3066-050)	BELLOWS PUMP	1513-001	320mm
W	SOCKET (3066-088)	PIPE NO:1 (6001-961)	1513-010	580mm
X	CONNECTION BLOCK ASSY	PIPE	1513-010	580mm (5X)
Y	BELLOWS PUMP	PIPE	1513-010	700mm (4X)
Z	BELLOWS PUMP	WASHPLACE SAMPLE	1513-009	350mm

TUBING DIAGRAM



TUBE CONNECTOR PLATE ASSEMBLY 6001-787

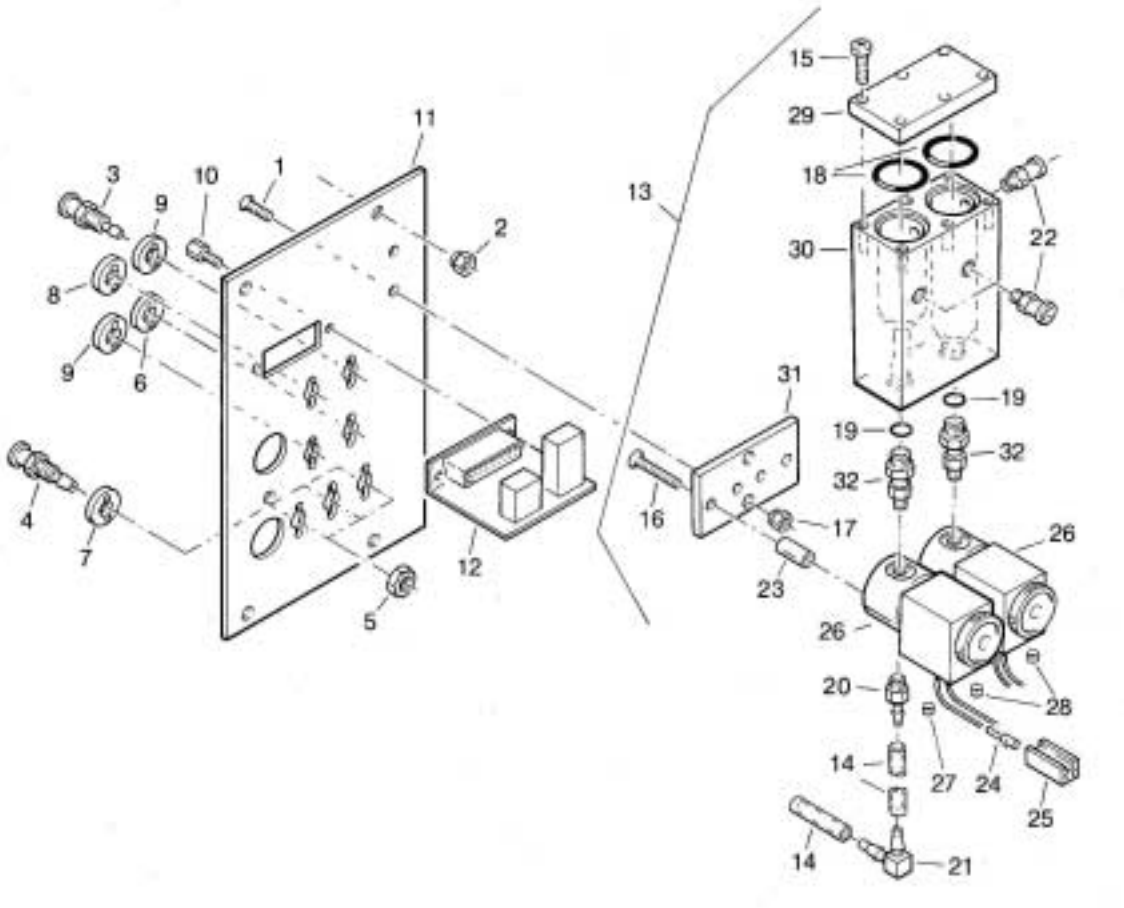
PART NUMBER	DESCRIPTION	LOCATION
3004-211	SCREW ST.ST. M3X8	1
3019-013	NUT INSERT ST. M3 (1.8mm)	2
3066-095	SOCKET 2.5	3
3066-096	SOCKET 3.4	4
3066-097	NUT	5
3066-098	CODE RING (WHITE)	6
3066-100	CODE RING (RED)	7
3066-101	CODE RING (GREEN)	8
3066-102	CODE RING (BLUE)	9
3370-525	SCREWLOCKS FEMALE	10
4802-332	PLATE	11
6001-770	CABELFILTER BOARD	12
6001-788	COLLECTING CASK ASSY	13

COLLECTING CASK ASSY 6001-788

PART NUMBER	DESCRIPTION	LOCATION
1513-002	PVC TUBE R. 4X6CLEAR	14
3002-020	SCREW ST.ST. M3X12	15
3004-216	SCREW ST.ST. M3X20	16
3019-013	NUT INSERT ST. M3 (1.8mm)	17
3029-058	O-RING 16X2 FPM/VITON	18
3029-060	O-RING 7X1 FPM/VITON	19
3066-090	CONNECTOR	20
3066-092	ELBOW	21
3066-111	CONNECTOR NYLON WHITE	22
3105-028	BUSH	23
6001-965	VALVE 2-WAY INCL CONNECTOR	26
4501-516	PLATE	29
4501-517	BLOCK	30
4509-174	PLATE	31
6001-733	CONNECTOR ASSY	32

In case of a standard instrument (without concentrated waste) the collecting cask contains one single chamber. Part. No. 6002-172

CONNECTOR PLATE ASSY + COLLECTING CASK ASSY

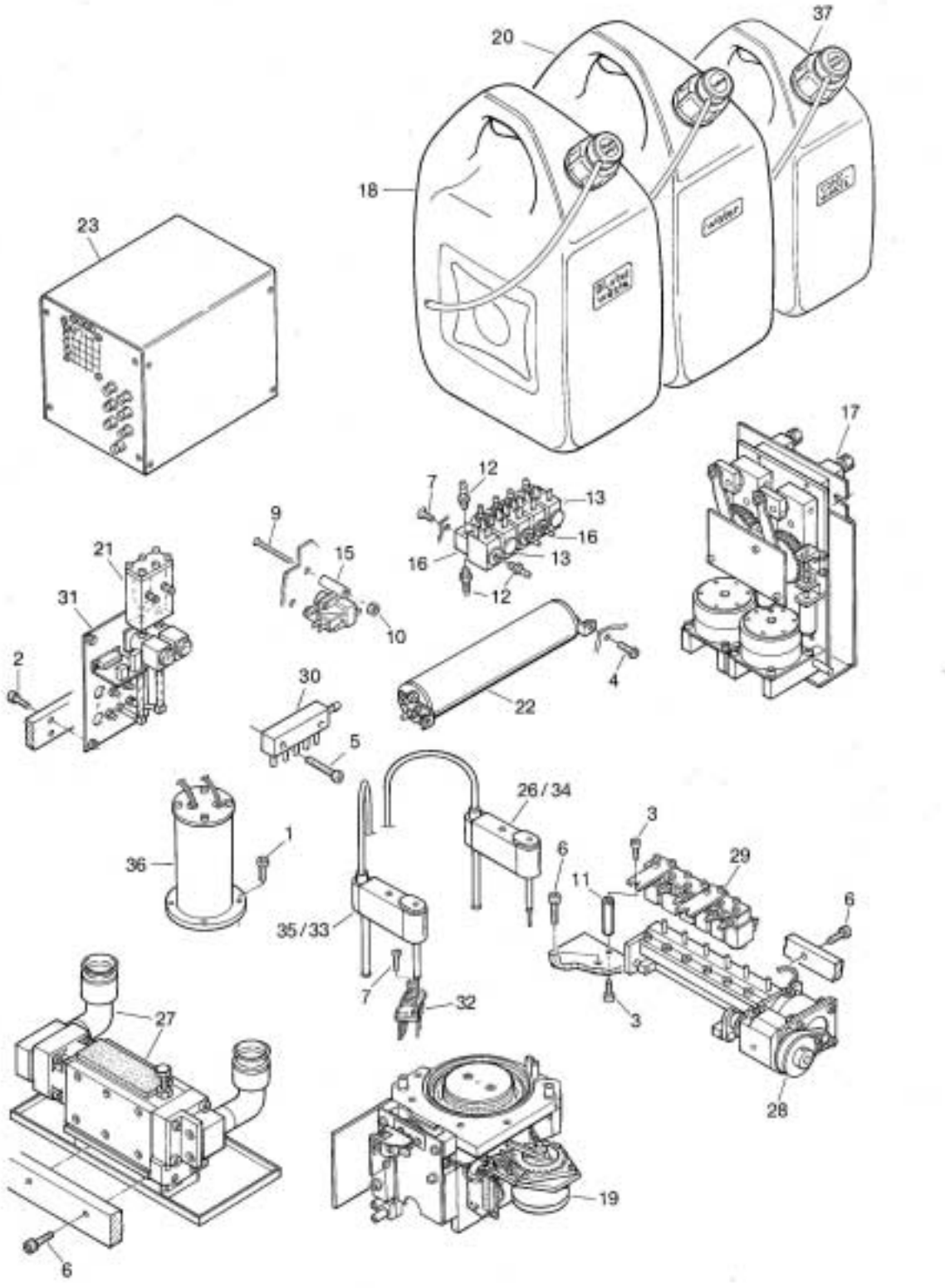


Note: This drawing is valid for the instrument version with the concentrated waste option installed.

ASSEMBLY OF MAIN UNITS FOR WATER AND VACUUM SYSTEM

PART NUMBER	DESCRIPTION	LOCATION
3002-018	SCREW M3X8	1
3002-019	SCREW M3X10	2
3002-027	SCREW M4X10	3
3004-210	SCREW M3X6	4
3002-313	SCREW M3X16	5
3002-336	SCREW M4X16	6
3004-211	SCREW M3X8	7
3004-218	SCREW M3X30	9
3011-016	NUT M3	10
3019-021	STUD M4	11
3066-052	CONNECTOR	12
3070-338	COVER	14
3344-004	VACUUM DETECTOR	15
6001-754	PIPETTOR UNIT	17
6001-826	DILUTED WASTE CONTAINER	18
6001-756	MEASURING UNIT	19
6001-860	WATER CONTAINER	20
6001-788	COLLECTING CASK ASSY	21
6001-423	VACUUM TUBE	22
6001-753	EXTERNAL PUMP UNIT	23
6001-797	HEAT EXCHANGER REAGENT ROTOR	27
6001-839	BELLOWS PUMP	28
6002-172	CONNECTION BLOCK ASSEMBLY	30
6001-787	CONNECTION PLATE ASSEMBLY	31
6001-961	WASH ARM	32
6001-786	WATER CASK	36
6001-827	CONCENTRATED WASTE CONTAINER	37

ASSEMBLY OF MAIN UNITS FOR WATER AND VACUUM SYSTEM



WATER CASK 6001-786

PART NUMBER	DESCRIPTION	LOCATION
3002-013	SCREW ST.ST.M2,5X10	1
3004-226	SCREW ST.ST. M4X8	2
3029-020	O-RING 036-36624	3
3066-052	CONN. 10/32 UNF	4
3344-015	SWITCH.LIQUID.LEVEL	5
3350-107	CONN. 1PM	6
3352-019	CONN. HOUSING 6P	7
4100-492	PROP	8
4100-527	PIPE	9
4100-531	BUSH	10
4100-558	PROP	11

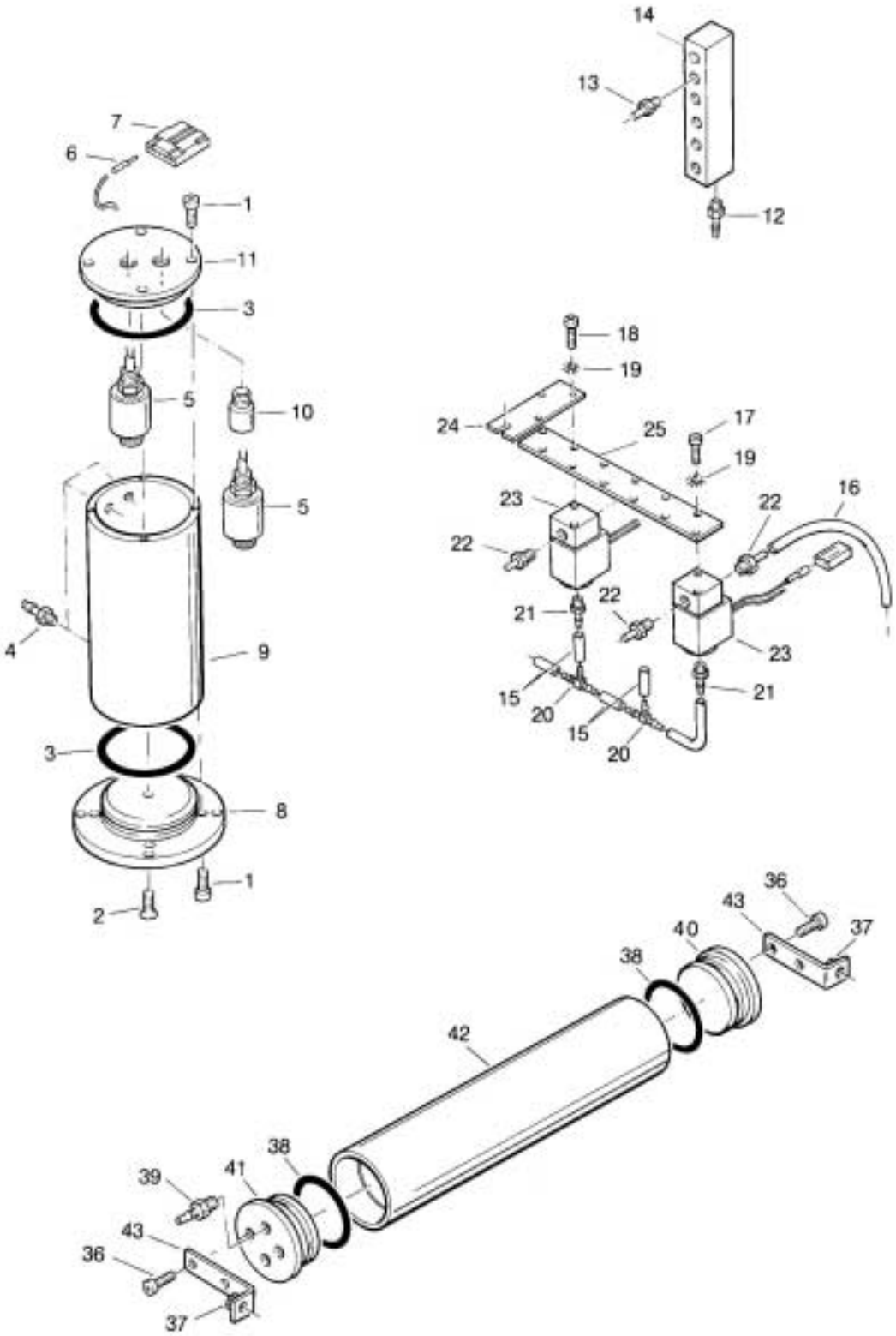
WASTE TUBES CONNECTION BLOCK ASSEMBLY 6002-172

PART NUMBER	DESCRIPTION	LOCATION
3066-052	CONNECTOR	12
3066-089	CONNECTOR	13
4501-567	BLOCK	14

VACUUM TUBE 6001- 423

PART NUMBER	DESCRIPTION	LOCATION
3002-019	SCREW ST.ST.M3X10	36
3019-013	NUT INSERT ST. M3	37
3029-010	RING	38
3066-052	CONNECTOR	39
4100-478	PLUG	40
4100-479	PLUG	41
4104-091	PIPE	42
4803-398	BRACKET	43

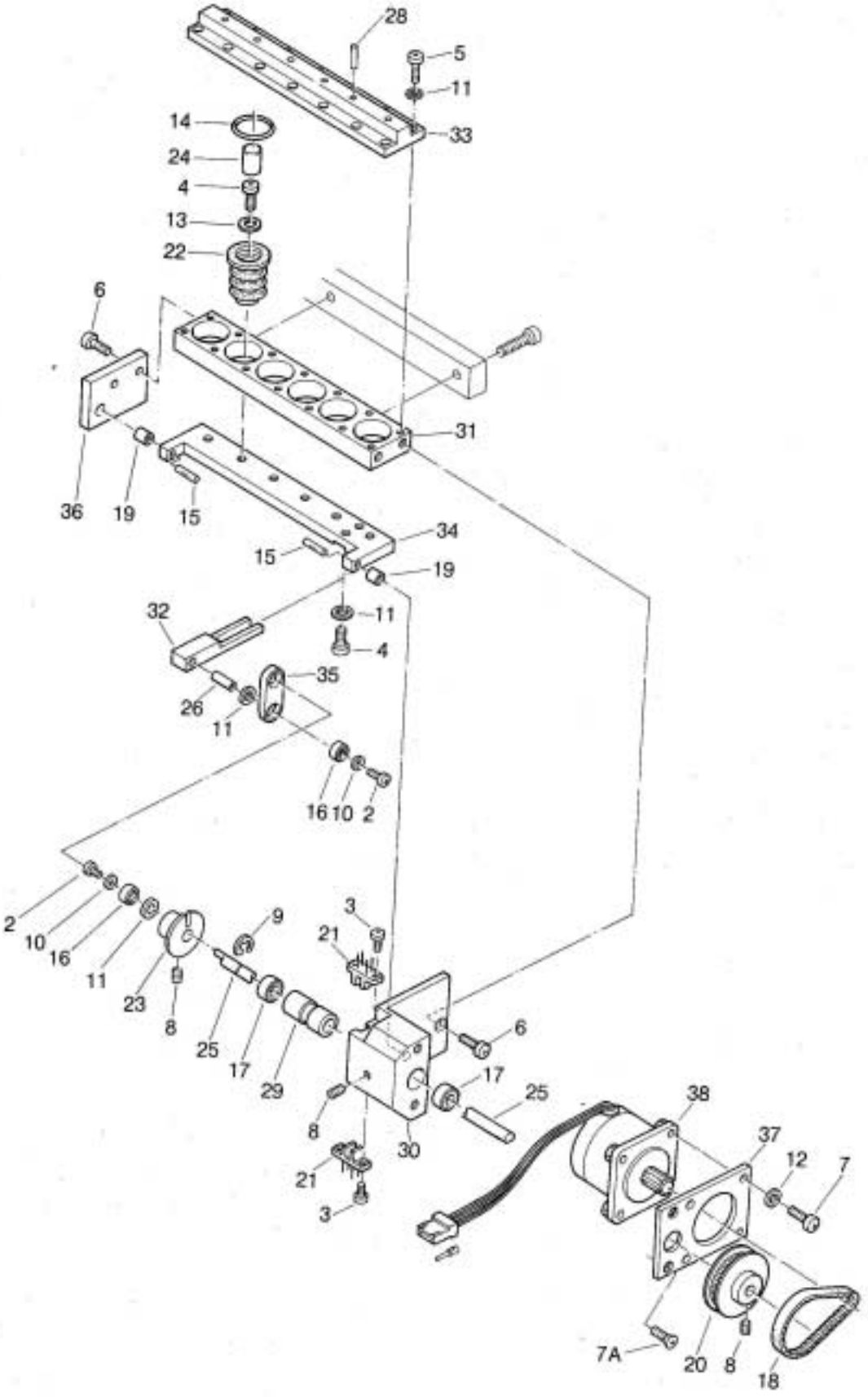
WATERCASK + CONNECTION BLOCK ASSY + VACUUM TUBE



BELLOWS PUMP 6001-839

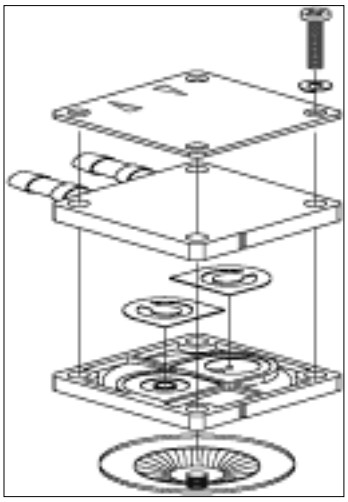
PART NUMBER	DESCRIPTION	LOCATION
1513-009	PVC TUBE 1.5X3.5 MM	1
3002-001	SCREW ST.ST. M2X4	2
3002-018	SCREW ST.ST. M3X8	3
3002-019	SCREW ST.ST. M3X10	4
3002-020	SCREW ST.ST. M3X12	5
3002-026	SCREW ST.ST. M4X8	6
3002-028	SCREW ST.ST. M4X12	7
3004-212	SCREW ST.ST. M4X12	7A
3008-040	SCREW ST.ST. M4X5	8
3020-020	CIRCLIP	9
3022-005	WASHER ST.ST. 2.2	10
3022-010	WASHER ST.ST. 3.2	11
3022-015	WASHER ST.ST. 4.3	12
3022-030	WASHER ST.ST. 3.2	13
3029-039	O-RING 24X2-36624	14
3030-028	DOWEL PIN 3m6X16	15
3053-002	BEARINGBALL 3X10X4	16
3053-025	BEARINGBALL 6X15X5	17
3064-018	TIMING BELT T 2,5/160	18
3106-016	BEARING BUSH	19
3130-081	SPROCKET	20
3381-053	OPTO INTERRUPTOR H21B1	21
4100-347	BELLOWS	22
4100-532	BUSH	23
4102-246	PLUG	24
4102-352	SHAFT	25
4102-346	SHAFT	26
4104-085	PIPE	28
4105-192	BUSH	29
4501-464	BLOCK	30
4501-465	BLOCK	31
4502-291	BEAM	32
4509-122	CAP	33
4802-251	PLATE	34
4802-252	PLATE	35
4802-253	PLATE	36
4802-254	PLATE	37
6001-831	BELLOWS MOTOR UNIT	38

BELLOWS PUMP

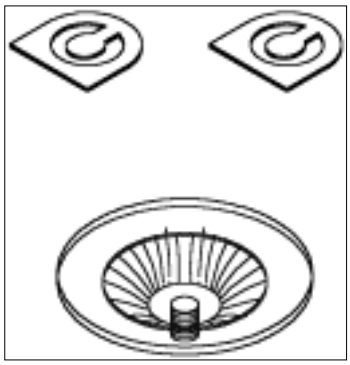


EXTERNAL PUMP UNIT 6001-753

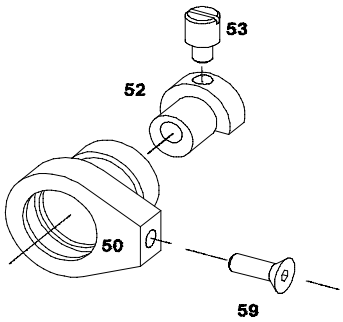
PART NUMBER	DESCRIPTION	LOCATION
1513-001	PVC TUBE R. 2 X 4 CL.	1
1513-002	PVC TUBE R. 4X6 CLEAR	2
3002-016	SCREW ST.ST. M3X6	3
3002-018	SCREW ST.ST. M3X8	4
3002-026	SCREW ST.ST. M4X8	5
3002-027	SCREW ST.ST. M4X10	6
3002-030	SCREW ST.ST. M4X6	7
3002-033	SCREW ST.ST. M4X40	8
3002-322	SCREW ST.ST. M3X40	9
3004-213	SCREW ST.ST. M3X8	10
3011-011	NUT ST.ST. M3	11
3019-013	NUT INSERT ST. M3 (1.8mm)	12
3019-014	NUT INSERT ST.GAL M4 (1.8 mm)	13
3022-015	WASHER ST.ST. 4.3	14
3066-052	CONN. 10/32 UNF	15
3066-087	SOCKET	16
3066-090	CONNECTOR	17
3066-095	SOCKET 2.5	18
3066-096	SOCKET 3.4	19
3066-097	NUT	20
3066-098	CODE RING (WHITE)	21
3066-100	CODE RING (RED)	22
3066-101	CODE RING (GREEN)	23
3066-102	CODE RING (BLUE)	24
3070-001	BUFFER PVC TRANSP	25
3070-018	BUFFER	26
3351-027	3P PANEL MOUNT CONN.	29
3365-014	PUMP VACUUM 12VDC	30
3370-042	SLEEVE CODE "1" YELLOW	32
3370-043	SLEEVE CODE "2" YELLOW	33
3370-053	FEED.THROUGH 1440015-4	34
3370-430	CLIPCABLE TIE INSULOK T18R-W	35
3370-525	SCREWLOCKS FEMALE	36
4105-130	BUSH	37
4502-360	BEAM	38
4800-181	PLATE	39
4800-190	PLATE	40
4802-295	PLATE	41
4802-296	PLATE	42
4802-333	PLATE	43
4803-404	BRACKET	44
4803-459	BRACKET	45
6001-770	CABELFILTER BOARD	46
6001-791	PUMP UNIT BOARD	47
6001-847	FAN UNIT	48
6001-881	WATER PUMP	49
3913-049	Membrane	
6002-041	Plunger kit	see drawing
6002-042	Chamber kit	chamber incl. membrane, see drawing
6001-516	Revisionset Waterpump	see drawing
6002-056	Membraneset Waterpump	see drawing



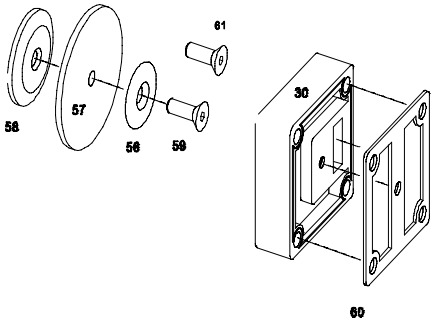
Revision set Waterpump 6001-516



Membraneset Waterpump 6002-056

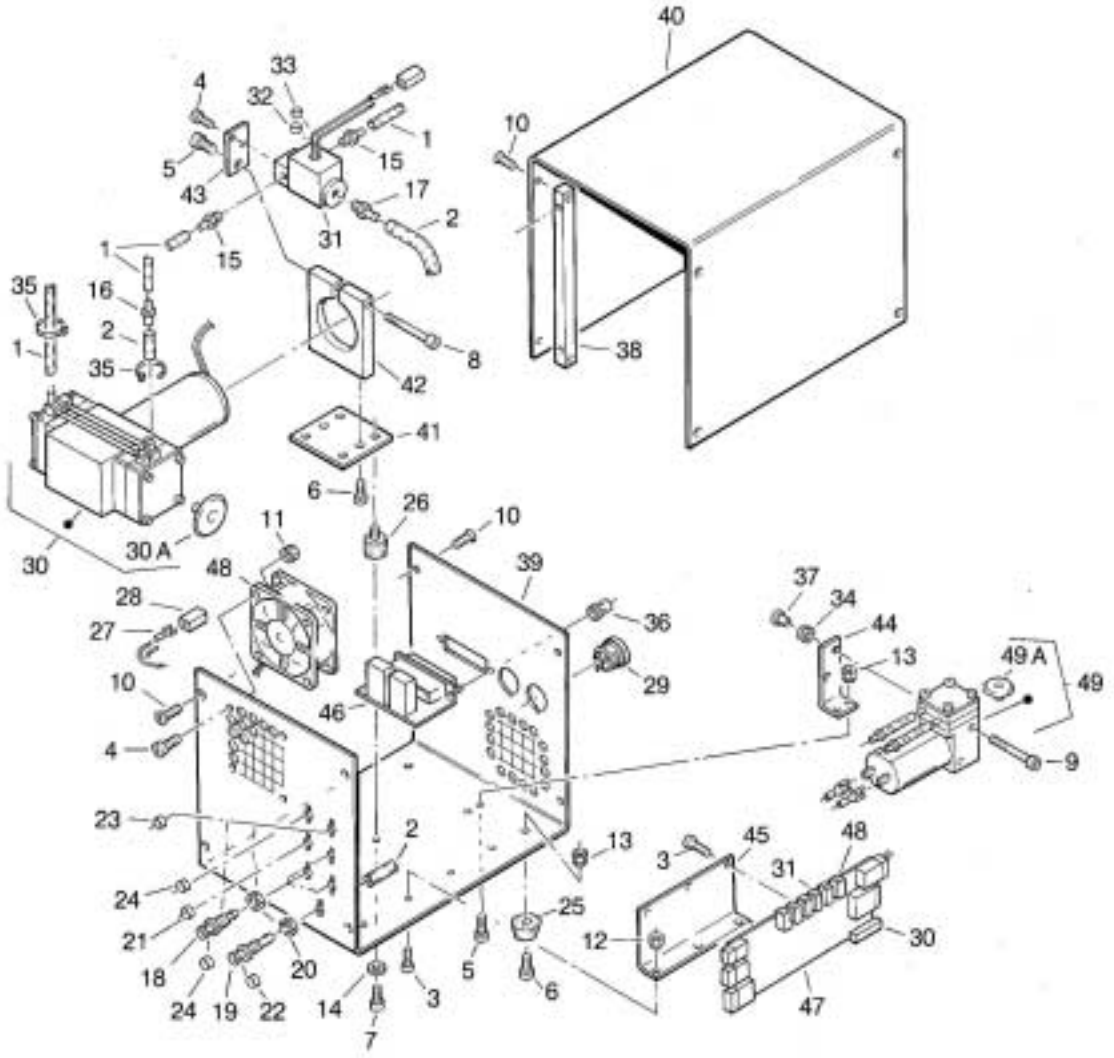


Plunger kit



Chamber kit

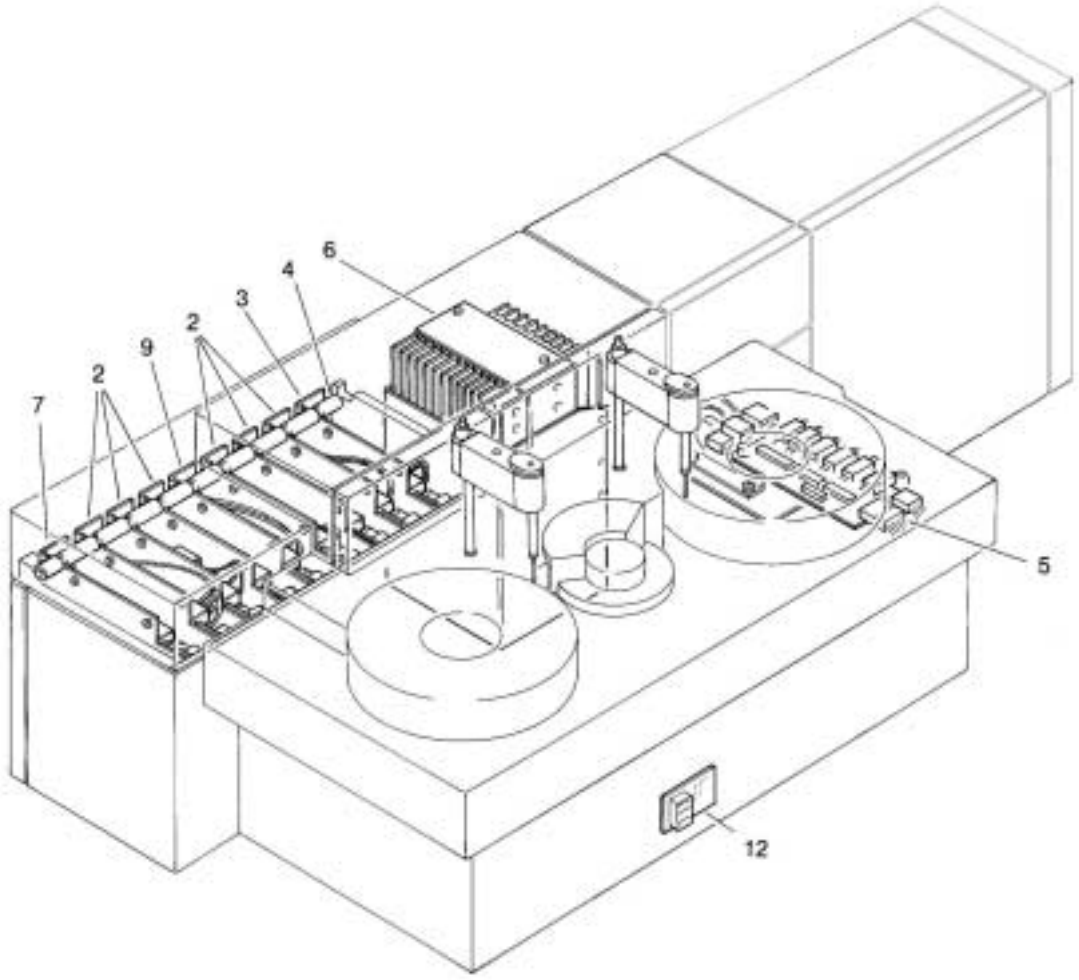
EXTERNAL PUMP UNIT



MAIN ELECTRICAL UNITS 6001-753

PART NUMBER	DESCRIPTION	LOCATION
6001-758	MOTION CONTROL BOARD	2
6001-759	SYSTEM BOARD	3
4102-354	SHAFT	4
6001-768	VALVE BOARD	5
6001-766	POWER UNIT	6
6001-761	PHOTOMETER BOARD	7
6001-771	TEMPERATURE BOARD	9
6001-858	TEMPERATURE COMPENSATION BOARD	12

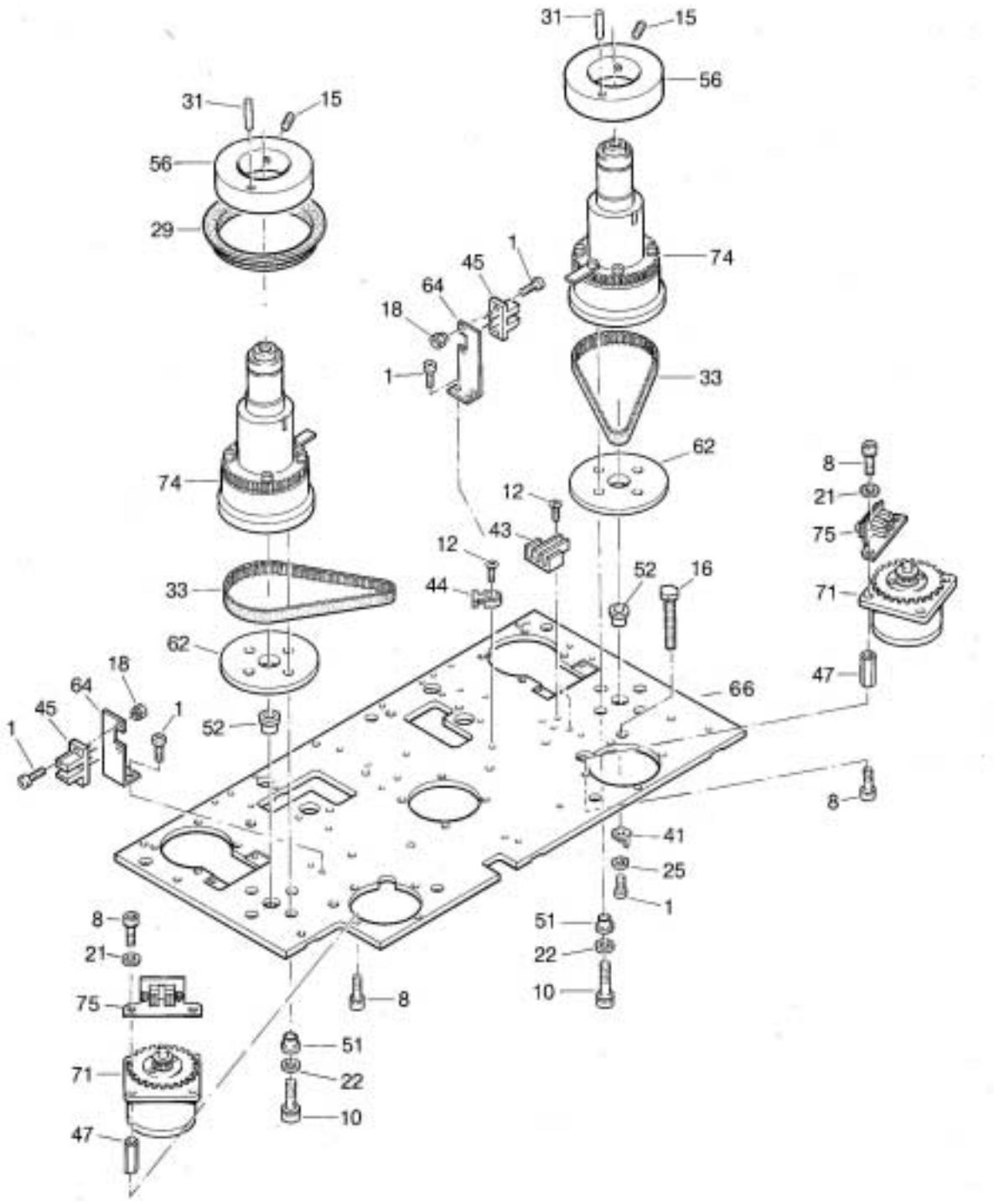
MAIN ELECTRICAL UNITS



MECHANICAL ASSEMBLY 6001-752 (sheet 1)

PART NUMBER	DESCRIPTION	LOCATION
3002-016	SCREW ST.ST. M3X6	1
3002-333	SCREW ST.ST. M4X12	8
3002-336	SCREW ST.ST. M4X16	9
3002-388	SCREW RVS M6X25	10
3002-621	SCREW ST.ST. M3X16	11
3004-211	SCREW ST.ST. M3X8	12
3008-024	SCREW ST.ST M3X5	13
3008-040	SCREW ST.ST. M4X5	14
3008-043	SCREW ST.ST. M4x12	15
3009-016	SCREW M8x50	16
3011-011	NUT ST.ST.M3	17
3011-019	NUT M4X27,5MM	18
3019-021	NUT M4	19
3022-015	WASHER ST.ST. 4.3	21
3022-025	WASHER ST.ST. 6.4	22
3023-010	WASH.LOCK ST.ST. M4	25
3023-042	SHIMRING	26
3023-035	SPRING WASHER	27
3029-017	O-RING 12x1.5	28
3029-051	V-SEAL RING	29
3030-045	DOWEL PIN 6M6X20	30
3030-051	DOWEL PIN 04M6X16	31
3053-001	BEARINGBALL 6X19X6	32
3064-017	TIMING BELT 132T T2,5	33
3070-038	TUBE CLAMP	34
3105-005	ADJ.RING 06H8X12X8	35
3105-006	ADJUSTING RING	36
3105-007	ADJUSTING RING	37
3106-113	BEARINGBUSH	38
3350-050	CONN. IP HDP-20PIN	39
3350-107	CONN. 1PM	40
3350-149	FASTON TAB	41
3352-019	CONN. HOUSING 6P	42
3370-444	TIE ANCHOR MOUNT NYLON	44
3381-053	OPTO INTERRUPTOR H21B1	45
4102-319	SHAFT	46
3019-049	STUD	47
4102-329	SHAFT	48
4102-331	SHAFT	49
4102-336	STUD	50
4105-186	BUSH	51
4105-187	BUSH	52
4105-196	BUSH	53
4105-197	BUSH	54
4106-227	RING	55
4106-268	RING	56
4501-461	BLOCK	58
4502-357	STRIP	59
4502-358	STRIP	60
4802-331	PLATE	61
4802-245	PLATE	62
4803-381	BRACKET	63
4803-383	BRACKET	64
4803-457	TOPPLATE	65
4803-458	BASEPLATE	66
6001-888	ARM RESET BOARD	67
6001-882	WASH ARM BOARD	69
6001-420	ADJUST BLOCK ASSY	70
6001-430	ENCODER STEPMOTOR UNIT	71
6001-756	MEASURING UNIT	72
	R&S STIRRING/ISE UNIT	73
6001-445	ROTOR UNIT	74
6001-930	ENCODER OPTO UNIT ROTORS	75
6001-448	CARRIAGE ASSY	76
6001-449	CLAMP ASSY	77
6001-931	ENCODER OPTO UNITS ARM	78
6001-455	UP/DOWN STEPMOTOR UNIT	79
6001-456	SWING UNIT	80
6001-811	MOVEMENT ASSY	81

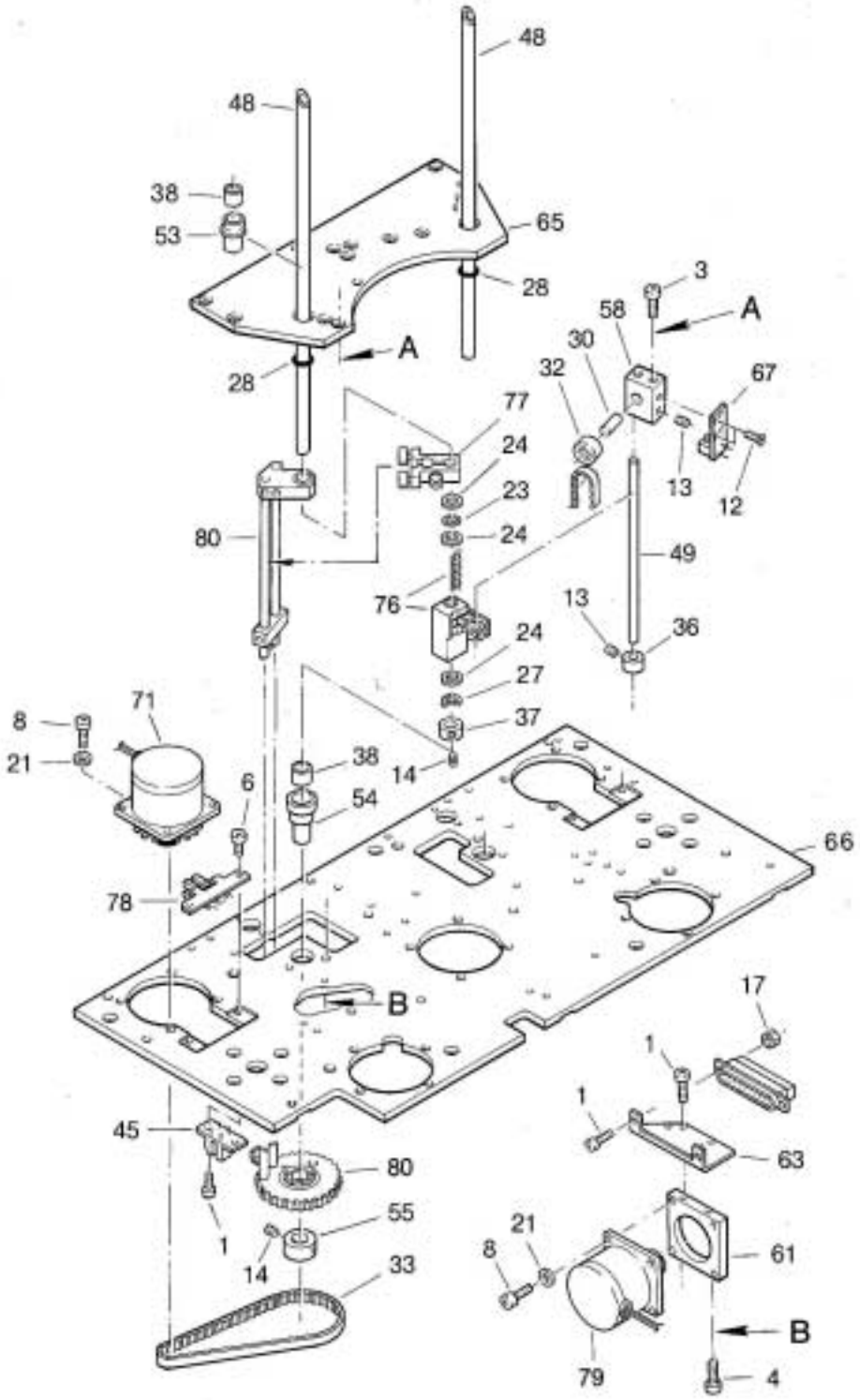
MECHANICAL ASSEMBLY SHEET 1



MECHANICAL ASSEMBLY 6001-752 (sheet 2)

PART NUMBER	DESCRIPTION	LOCATION
3002-016	SCREW ST.ST. M3X6	1
3002-030	SCREW ST.ST. M4X6	6
3002-333	SCREW ST.ST. M4X12	8
3002-336	SCREW ST.ST. M4X16	9
3002-388	SCREW RVS M6X25	10
3002-621	SCREW ST.ST. M3X16	11
3004-211	SCREW ST.ST. M3X8	12
3008-024	SCREW ST.ST M3X5	13
3008-040	SCREW ST.ST. M4X5	14
3008-043	SCREW ST.ST. M4x12	15
3009-016	SCREW M8x50	16
3011-011	NUT ST.ST.M3	17
3011-019	NUT M4X27,5MM	18
3019-021	NUT M4	19
3022-015	WASHER ST.ST. 4.3	21
3022-032	SHIM RING PS8X10X0.15	23
3023-006	LOCKWASHER J 3.2	24
3029-017	O-RING 12x1.5	28
3029-051	V-SEAL RING	29
3030-045	DOWEL PIN 6M6X20	30
3030-051	DOWEL PIN 04M6X16	31
3053-001	BEARINGBALL 6X19X6	32
3064-017	TIMING BELT 132T T2,5	33
3070-038	TUBE CLAMP	34
3105-005	ADJ.RING 06H8X12X8	35
3105-006	ADJUSTING RING	36
3105-007	ADJUSTING RING	37
3106-113	BEARINGBUSH	38
3350-050	CONN. IP HDP-20PIN	39
3350-107	CONN. 1PM	40
3350-149	FASTON TAB	41
3352-019	CONN. HOUSING 6P	42
3370-444	TIE ANCHOR MOUNT NYLON	44
3381-053	OPTO INTERRUPTOR H21B1	45
4102-319	SHAFT	46
3019-049	STUD	47
4102-329	SHAFT	48
4102-331	SHAFT	49
4102-336	STUD	50
4105-186	BUSH	51
4105-187	BUSH	52
4105-196	BUSH	53
4105-197	BUSH	54
4106-227	RING	55
4106-268	RING	56
4501-461	BLOCK	58
4502-357	STRIP	59
4502-358	STRIP	60
4802-331	PLATE	61
4802-245	PLATE	62
4803-381	BRACKET	63
4803-383	BRACKET	64
4803-457	TOPPLATE	65
4803-458	BASEPLATE	66
6001-888	ARM RESET BOARD	67
6001-882	WASH ARM BOARD	69
6001-420	ADJUST BLOCK ASSY	70
6001-430	ENCODER STEPMOTOR UNIT	71
6001-756	MEASURING UNIT	72
	R&S STIRRING/ISE UNIT	73
6001-445	ROTOR UNIT	74
6001-930	ENCODER OPTO UNIT ROTORS	75
6001-448	CARRIAGE ASSY	76
6001-449	CLAMP ASSY	77
6001-931	ENCODER OPTO UNITS ARM	78
6001-455	UP/DOWN STEPMOTOR UNIT	79
6001-456	SWING UNIT	80
6001-811	MOVEMENT ASSY	81

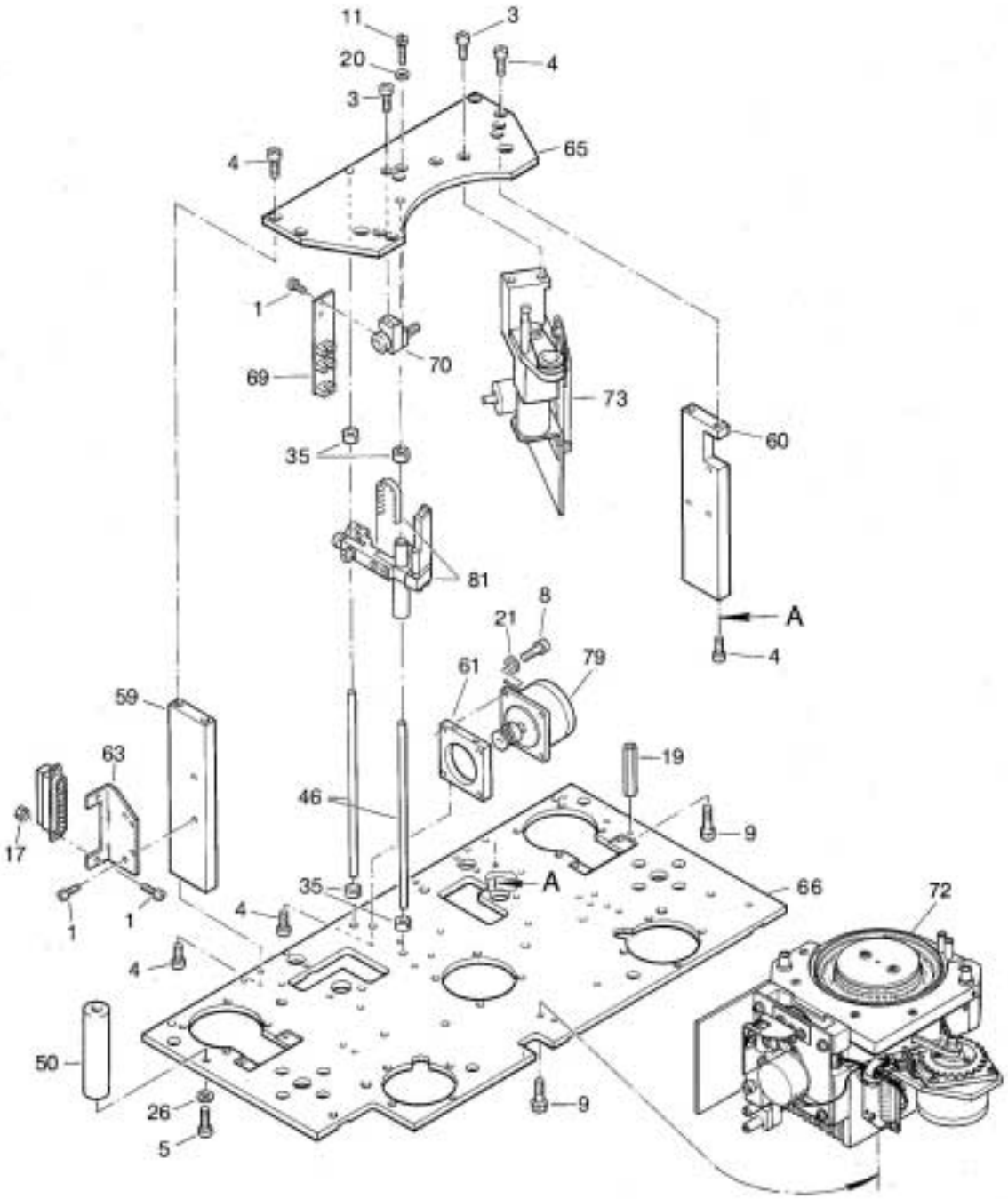
MECHANICAL ASSEMBLY SHEET 2



MECHANICAL ASSEMBLY 6001-752 (sheet 3)

PART NUMBER	DESCRIPTION	LOCATION
3002-016	SCREW ST.ST. M3X6	1
3002-028	SCREW ST.ST. M4X12	2
3002-026	SCREW ST.ST. M4X8	3
3002-027	SCREW ST.ST. M4X10	4
3002-029	SCREW ST.ST. M4X16	5
3002-333	SCREW ST.ST. M4X12	8
3002-336	SCREW ST.ST. M4X16	9
3002-388	SCREW RVS M6X25	10
3002-621	SCREW ST.ST. M3X16	11
3004-211	SCREW ST.ST. M3X8	12
3008-024	SCREW ST.ST M3X5	13
3008-040	SCREW ST.ST. M4X5	14
3008-043	SCREW ST.ST. M4x12	15
3009-016	SCREW M8x50	16
3011-011	NUT ST.ST.M3	17
3011-019	NUT M4X27,5MM	18
3019-021	NUT M4	19
3022-010	WASHER ST.ST. 3.2	20
3022-015	WASHER ST.ST. 4.3	21
3023-042	SHIMRING	26
3023-035	SPRING WASHER	27
3029-017	O-RING 12x1.5	28
3029-051	V-SEAL RING	29
3105-005	ADJ.RING 06H8X12X8	35
3105-006	ADJUSTING RING	36
3105-007	ADJUSTING RING	37
3106-113	BEARINGBUSH	38
3350-050	CONN. IP HDP-20PIN	39
3350-107	CONN. 1PM	40
3350-149	FASTON TAB	41
3352-019	CONN. HOUSING 6P	42
3370-444	TIE ANCHOR MOUNT NYLON	44
3381-053	OPTO INTERRUPTOR H21B1	45
4102-319	SHAFT	46
3019-049	STUD	47
4102-329	SHAFT	48
4102-331	SHAFT	49
4102-336	STUD	50
4105-186	BUSH	51
4105-187	BUSH	52
4105-196	BUSH	53
4105-197	BUSH	54
4106-227	RING	55
4106-268	RING	56
4501-461	BLOCK	58
4502-357	STRIP	59
4502-358	STRIP	60
4802-331	PLATE	61
4802-245	PLATE	62
4803-381	BRACKET	63
4803-383	BRACKET	64
4803-457	TOPPLATE	65
4803-458	BASEPLATE	66
6001-888	ARM RESET BOARD	67
6001-882	WASH ARM BOARD	69
6001-420	ADJUST BLOCK ASSY	70
6001-430	ENCODER STEPMOTOR UNIT	71
6001-756	MEASURING UNIT	72
	R&S STIRRING/ISE UNIT (drawing not like real!)	73
6001-445	ROTOR UNIT	74
6001-930	ENCODER OPTO UNIT ROTORS	75
6001-448	CARRIAGE ASSY	76
6001-449	CLAMP ASSY	77
6001-931	ENCODER OPTO UNITS ARM	78
6001-455	UP/DOWN STEPMOTOR UNIT	79
6001-456	SWING UNIT	80
6001-811	MOVEMENT ASSY	81

MECHANICAL ASSEMBLY SHEET 3



SWING UNIT 6001-456

PART NUMBER	DESCRIPTION	LOCATION
3002-016	SCREW ST.ST M3X6	1
3008-040	SCREW ST.ST M4X5	2
3053-034	BALLBEARING	3
3106-114	BEARING BUSH	4
3130-074	SPROCKET	5
4102-319	SHAFT	6
4501-456	BLOCK	7
4501-457	BLOCK	8
4802-239	VANE	9

CLAMP ASSEMBLY 6001-449

PART NUMBER	DESCRIPTION	LOCATION
3002-333	SCREW ST.ST M4X12	10
3022-010	WASHER ST.ST M4X12	11
3022-015	WASHER ST.ST 3.2	12
3030-023	DOWEL PIN	13
3053-002	BEARINGBALL	14
4509-118	CLAMP	15

CARRIAGE ASSEMBLY 6001-448

PART NUMBER	DESCRIPTION	LOCATION
3002-306	SCREW ST.ST M3X6	16
3022-010	WASHER ST.ST 3.2	17
3030-013	DOWEL PIN	18
3064-019	TIMING BELT T2.5	19
3106-113	BEARING BUSH	20
4105-183	BUSH	21
4501-458	CARRIAGE	22
4753-009	CLIP	23
4753-009	VANE	24

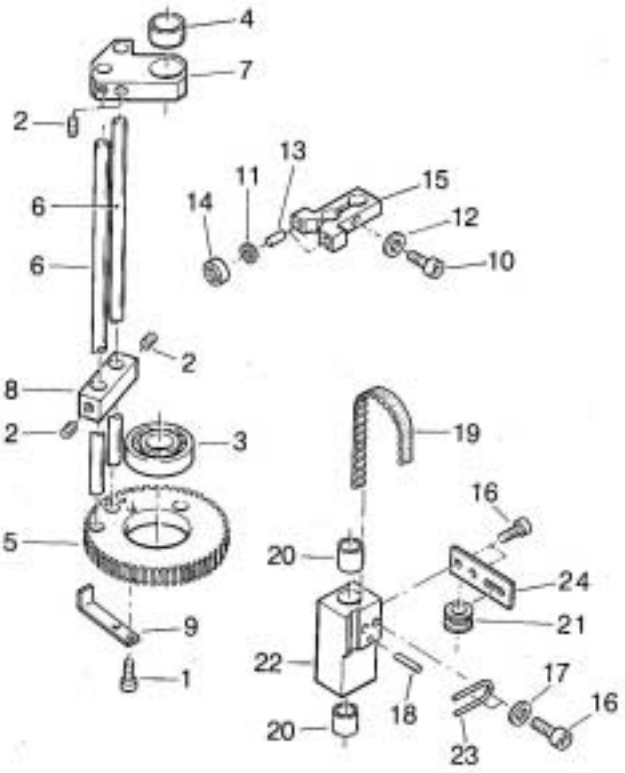
ENCODER OPTO UNIT 6001-930

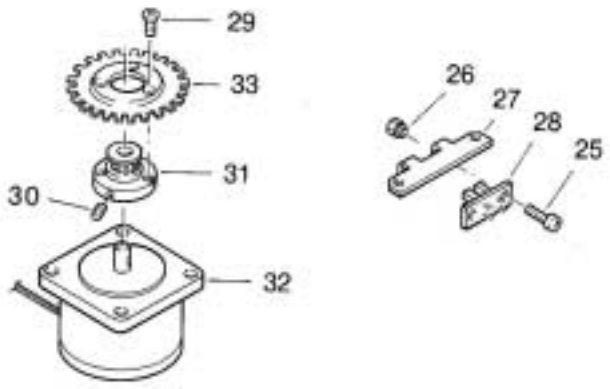
PART NUMBER	DESCRIPTION	LOCATION
3002-016	SCREW ST.ST. M3X6	25
3019-011	NUT INSERT ST. M3	26
4803-472	BRACKET	27
6001-900	ENCODER OPTO BOARD	28

ENCODER STEPPER MOTOR UNIT 6001-430

PART NUMBER	DESCRIPTION	LOCATION
3004-204	SCREW ST.ST M2X6	29
3008-040	SCREW ST. M4X5	30
3130-076	SPROCKET T2,5/15	31
3363-505	STEPPER MOTOR	32
4700-543	ENCODER DISC	33

SWING UNIT
CLAMP ASSY
CARRIAGE ASSY
ENCODER OPTO
ENCODER STEPPER MOTOR UNIT





STIRRING UNIT with ISE NEEDLE 6001-783 (optional)

STIRRING UNIT 6002-023

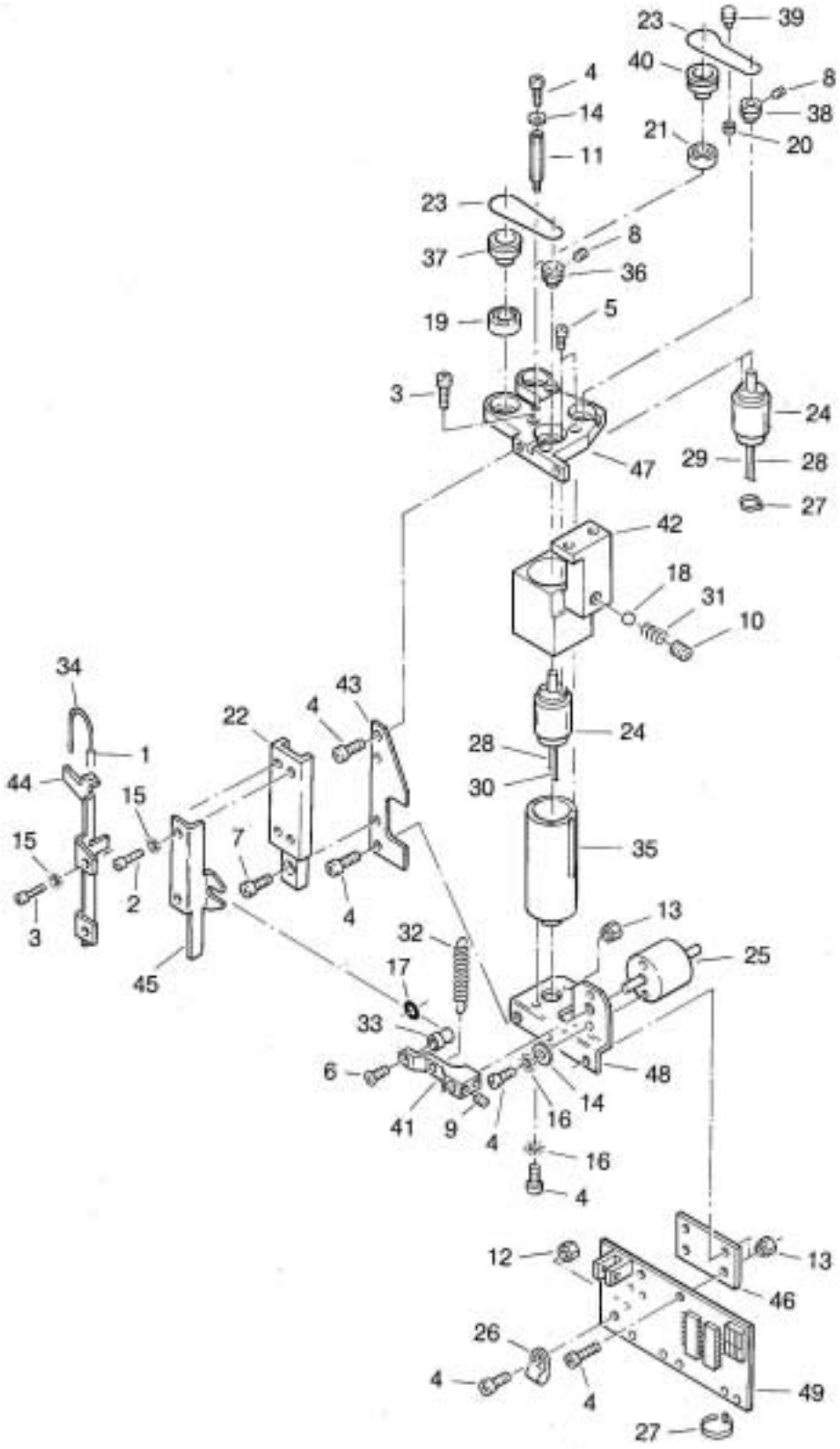
PART NUMBER	DESCRIPTION	LOCATION
1573-002	SIL. TUBE 0.7 X 2.7 MM	1
3002-001	SCREW ST.ST. M2X4	2
3002-002	SCREW ST.ST. M2X5	3
3002-016	SCREW ST.ST. M3X6	4
3002-122	SCREW ST.ST M1.6X3	5
3004-007	SCREW ST.ST. M2X6	6
3004-203	SCREW ST.ST M2X5	7
3008-020	SCREW ST.ST. M3X3	8
3008-040	SCREW ST.ST. M4X5	9
3008-125	SCREW ST.ST. M6X5	10
3009-025	SCREW	11
3019-011	NUT INSERT ST. M3 (0.9mm)	12
3019-013	NUT INSERT ST. M3 (1.8mm)	13
3022-010	WASHER ST.ST. 3.2	14
3023-003	LOCKWASHER J 2.2	15
3023-006	LOCKWASHER J 3.2	16
3029-001	O-RING 2.9 X 1.78 BUNA	17
3053-005	BALL 5MM BALLBEARINGSTEEL	18
3053-020	BEARINGBALL 8X16X5 ADR-WX8ZZ	19
3053-037	BALLBEARING 02.5X06X2.6	20
3053-038	BALL BEARING 07X014X5	21
3053-204	BALL SLIDE ASSEMBLY AD-2	22
3064-041	BELT DRIVING	23
3363-625	MOTOR BALLBEARING 18VDC	24
3366-301	ROTARY SOLENOID 30VDC	25
3370-401	CLIP.CABLE.NXO	26
3370-430	CLIPCABLE TIE INSULOK T18R-W	27
3372-010	WIRE 0.15 BLACK	28
3372-024	WIRE 0.15 WHITE/ORANGE	29
3372-025	WIRE 0.15 WHITE/GREEN	30
3750-043	SPRING	31
3751-024	SPRING	32
4100-650	PEN	33
4104-083	PIPE	34
4105-238	BUSH	35
4129-017	PULLEY	36
4129-018	PULLEY	37
4129-019	PULLEY	38
4129-020	PULLEY	39
4129-021	PULLEY	40
4501-511	LEVER	41
4501-512	BLOCK	42
4509-162	STRIP	43
4509-163	NEEDLE HOLDER	44
4509-165	PLATE	45
4509-167	PLATE	46
4802-330	PLATE	47
4803-450	BRACKET	48
6001-773	STIRRER DRIVER BOARD	49

Parts specific for the ISE-arm are optional and not present in all instruments.

Maintenance parts for stirrer unit:

PART NUMBER	DESCRIPTION	LOCATION
6001-982	Bearing assembly sample mixer	19 + 37
6001-983	Bearing assembly reagent mixer	21 + 40

STIRRING / ISE UNIT



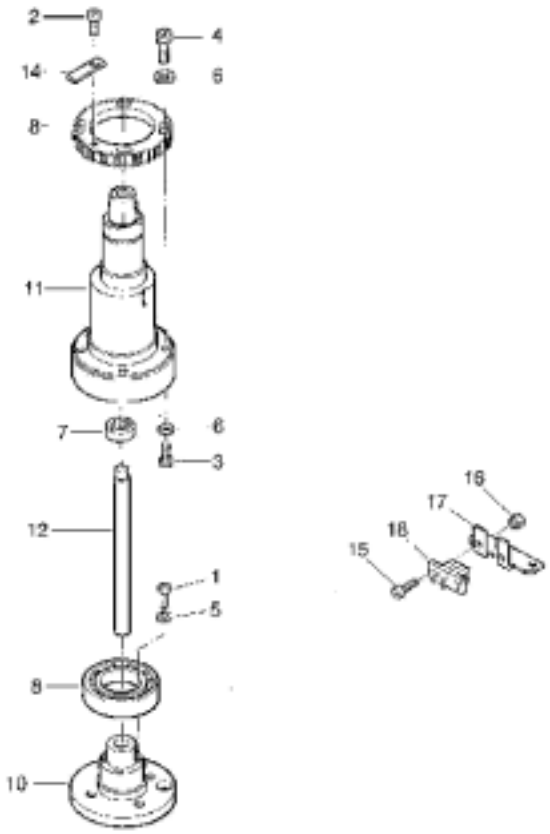
SAMPLE / REAGENT ROTOR BASE UNIT 6001- 445

PART NUMBER	DESCRIPTION	LOCATION
3002-015	SCREW ST.ST M3X4	1
3002-016	SCREW ST.ST M3X6	2
3002-030	SCREW ST.ST M4X6	3
3002-336	SCREW ST.ST M4X16	4
3022-010	WASHER ST.ST 3.2	5
3022-015	WASHER ST.ST 4.3	6
3053-001	BEARING BALL	7
3053-035	BALLBEARING	8
3130-077	SPROCKET	9
4100-447	HOLDER	10
4102-355	SHAFT	11
4102-324	SHAFT	12
4802-250	VANE	14

ENCODER UNIT FOR ROTOR 6001- 930

PART NUMBER	DESCRIPTION	LOCATION
3002-016	SCREW ST.ST. M3X6	15
3019-011	NUT INSERT ST. M3	16
4803-472	BRACKET	17
6001-900	ENCODER OPTO BOARD	18

ROTOR UNIT REAGENT / SAMPLE ROTOR



WASH ARM ASSEMBLY

MOVEMENT ASSEMBLY 6001- 811

PART NUMBER	DESCRIPTION	LOCATION
3002-016	SCREW ST.ST. M3X6	1
3002-307	SCREW ST.ST. M3X8	2
3002-318	SCREW M3X25	3
3002-336	SCREW ST.ST. M4X16	4
3004-212	SCREW ST.ST. M3X10	5
3008-034	SCREW ST. M3X10	6
3011-011	NUT ST. M3	7
3022-010	WASHER ST.ST. 3.2	8
3022-015	WASHER ST.ST. 4.3	9
3030-023	DOWEL PIN	10
3053-002	BEARINGBALL	11
3064-019	TIMING BELT	12
3106-109	BEARING	13
3366-122	SOLDERTAG	14
3370-401	CLIP CABLE	15
4105-184	BUSH	16
4105-185	BUSH	17
4501-459	BLOCK	18
4501-460	BLOCK	19
4502-290	BEAM	20
4753-010	CLIP	21
4802-242	PLATE	22
4802-243	VANE	23

UP/DOWN STEPPER MOTOR 6001- 455

PART NUMBER	DESCRIPTION	LOCATION
3008-024	SCREW ST. M3X5	24
3130-075	SPROCKET T2.5/15	25
3363-505	STEPPER MOTOR	26

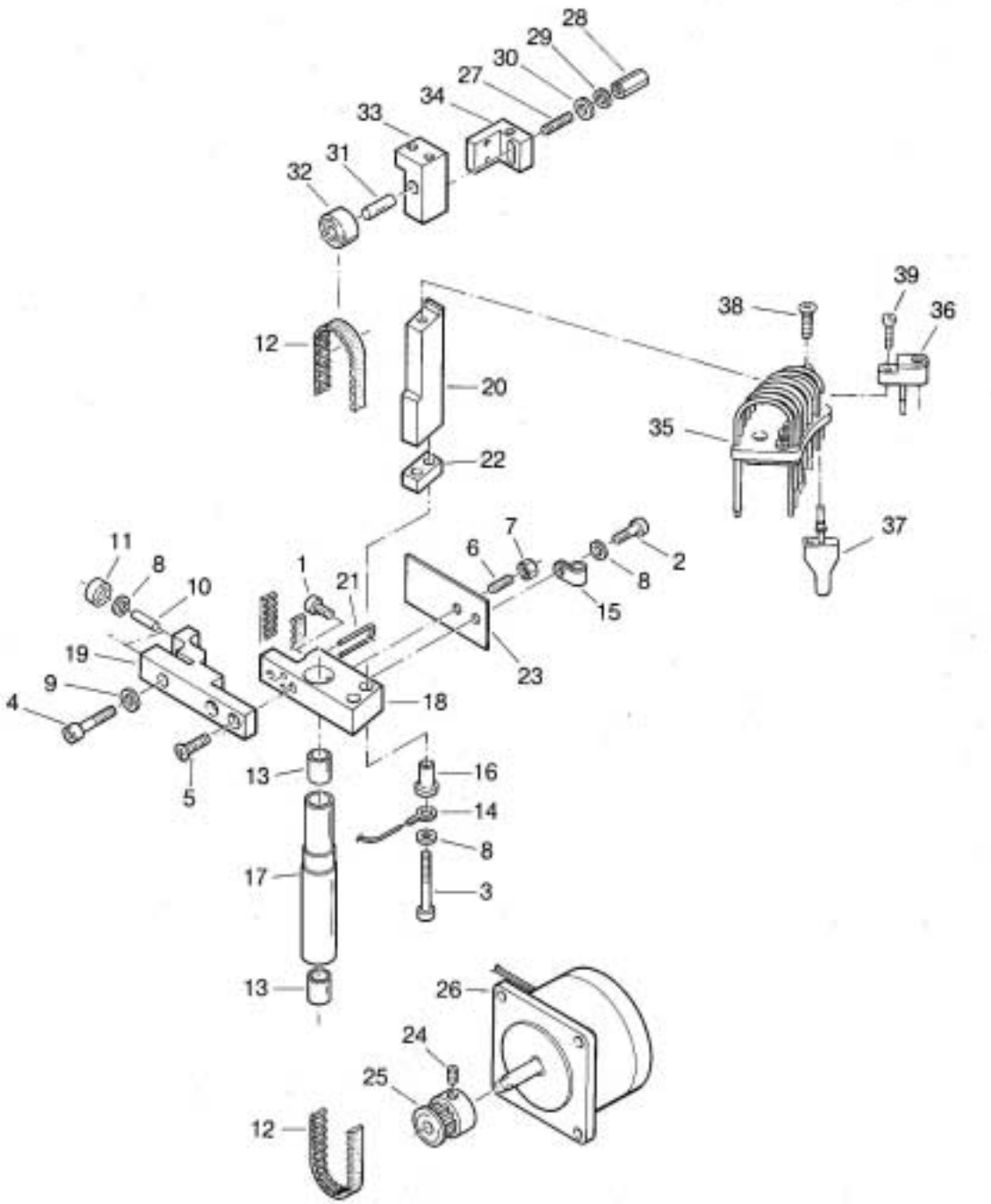
ADJUST BLOCK ASSEMBLY 6001- 420

PART NUMBER	DESCRIPTION	LOCATION
3008-038	SCREW ST. M3X16	27
3019-009	NUT M3	28
3022-030	WASHER ST.ST. 3.2	29
3023-055	SCR SPR	30
3030-045	DOWEL PIN	31
3053-001	BEARINGBALL	32
4501-501	BLOCK	33
4501-502	BLOCK	34

WASH ARM 6001- 961

PART NUMBER	DESCRIPTION	LOCATION
6001-961	WASH ARM	35
6001-962	BLOCK ASSY	36
6001-963	FILTERBLOCK ASSY	37
3004-211	SCREW M3X8	38
3002-007	SCREW	39

WASH ARM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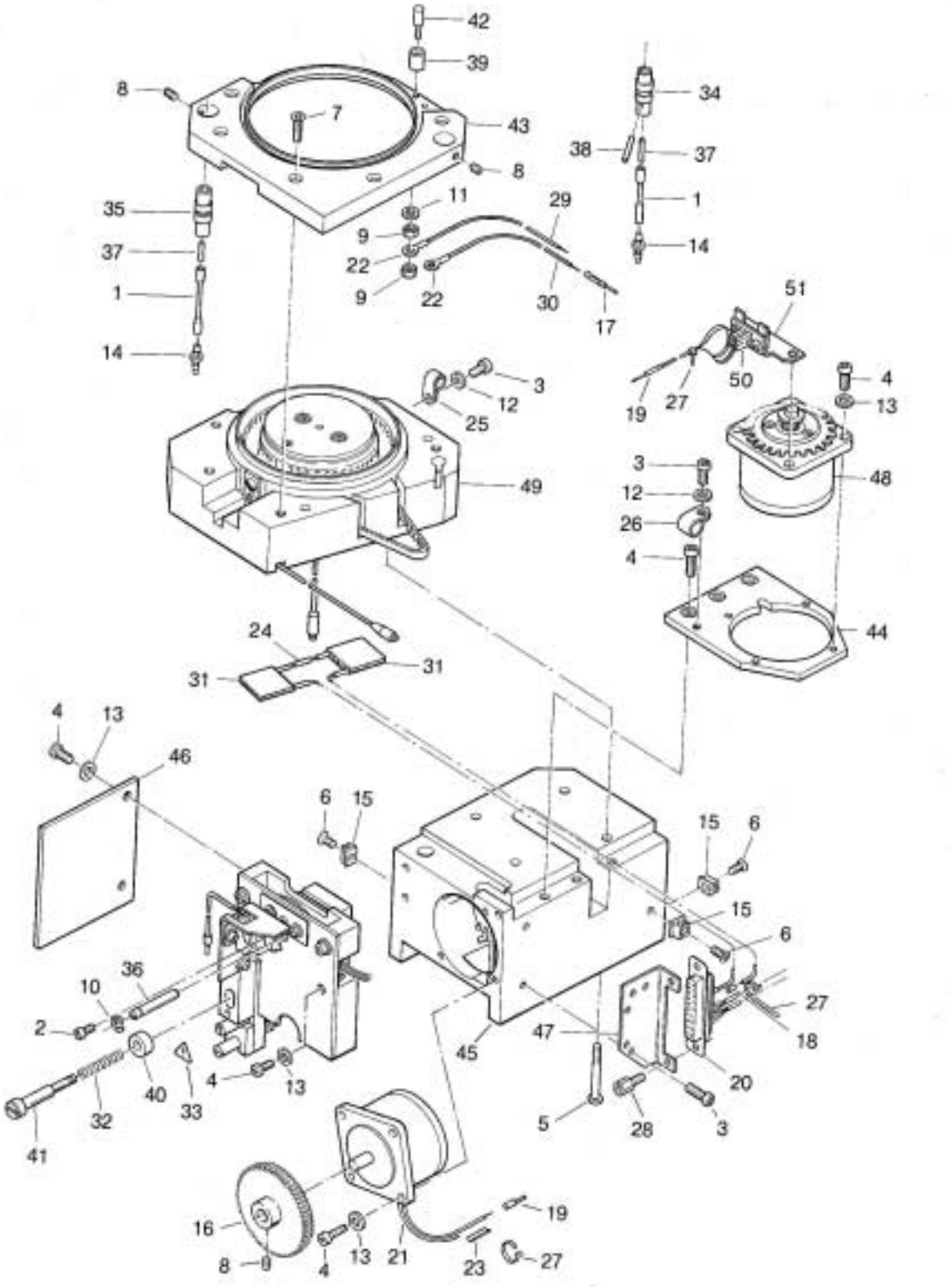
MEASURING UNIT 6001- 756

PART NUMBER	DESCRIPTION	LOCATION
1513-009	PVC TUBE 1.5X3.5 MM	1
3002-015	SCREW ST.ST. M3X4	2
3002-016	SCREW ST.ST. M3X6	3
3002-028	SCREW ST.ST. M4X12	4
3002-034	SCREW ST.CAD M4X45	5
3004-210	SCREW ST.ST. M3X6	6
3004-230	SCREW ST.ST. M4X20	7
3008-040	SCREW ST. M4X5	8
3011-004	NUT ST.ST. M2	9
3020-017	CIRCLIP 4	10
3022-005	WASHER ST.ST. 2.2	11
3022-010	WASHER ST.ST. 3.2	12
3022-015	WASHER ST.ST. 4.3	13
3066-088	SOCKET #AD1	14
3070-038	TUBE.CLAMP	15
3130-082	GEAR M=1 Z=60	16
3350-004	CONN. HDP-20 PIN CONTACT	17
3350-008	CONN. SOLDER PIN CONTACT	18
3350-050	CONN IP HDP-20 PIN	19
3353-183	CONN.37P HDP-20 PLUG.H	20
3363-505	STEPPER MOTOR	21
3366-120	SOLDERTAG	22
3370-004	SLEEVE CABLE	23
3370-006	SLEEVE CABLE	24
3370-401	CLIP CABLE NX0	25
3370-410	CLIP.CABLE.NX3	26
3370-430	CLIPCABLE TIE	27
3370-525	SCREWLOCKS FEMALE	28
3372-003	WIRE 0.15 GREY	29
3372-007	WIRE 0.15 VIOLET	30
3390-013	PELTIER ELEMENT	31
3750-036	SPRING	32
3820-255	STICKER "EXCLAMATION MARK"	33
4100-461	WASTE CUP (SAMPLE)	34
4100-557	WASTE CUP (REAG)	35
4102-330	SHAFT	36
4104-085	PIPE	37
4104-089	PIPE	38
4105-225	BUSH	39
4106-226	RING	40
4107-072	SCREW	41
4107-085	SCREW	42
4509-171	PLATE	43
4509-172	PLATE	44
4509-176	HEATSINK BLOCK	45
4801-100	PLATE	46
4803-381	BRACKET	47
6001-430	ENCODER STEPMOTOR UNIT	48
6001-757	MAIN ASSEMBLY	49
6001-817	MEASURING OPTO UNIT CABLE	50
6001-930	ENCODER OPTO UNIT ROTORS	51

MEASURING UNIT



MAIN ASSEMBLY MEASURING UNIT 6001-757

PART NUMBER	DESCRIPTION	LOCATION
3002-025	SCREW ST.ST. M3X30	1
3004-214	SCREW ST.ST. M3X12	2
3022-010	WASHER ST.ST. 3.2	3
3029-049	O-RING 36X2	4
3064-017	BELT TIMING 132T T2,5	5
6001-464	INNER STATOR ASSY	6
6001-465	ROTOR ASSY	7
6001-820	STATOR ASSY	8
6001-782	INSULATION ASSY	9

INNER STATOR ASSEMBLY 6001- 464

PART NUMBER	DESCRIPTION	LOCATION
3002-005	SCREW ST.ST. M2X12	10
3008-040	SCREW ST.ST. M4X5	11
3022-005	WASHER ST.ST. 2.2	12
3060-053	LENS 08 F13.5	13
3750-007	SPRING	14
4100-452	INNER STATOR	15
4105-193	BUSH	16
4501-466	BLOCK	17
6001-447	PHOTO DIODE UNIT	18

ROTOR ASSEMBLY 6001- 465

PART NUMBER	DESCRIPTION	LOCATION
3053-036	BALL BEARING	19
3130-080	SPROCKET	20
4509-150	ROTOR	21

STATOR ASSEMBLY 6001- 820

PART NUMBER	DESCRIPTION	LOCATION
3002-015	SCREW ST.ST. M3X4	22
3029-040	O-RING	23
3060-053	LENS 08 F13.5	24
4509-151	STATOR	25
4802-286	PLATE	26
6001-822	THERMISTOR ASSEMBLY	27
6001-821	ROTOR RESET BOARD	28

INSULATION ASSEMBLY 6001- 782

PART NUMBER	DESCRIPTION	LOCATION
3002-002	SCREW ST.ST. M2X5	29
3002-018	SCREW ST.ST. M3X8	30
3022-005	WASHER ST.ST. 2.2	31
3022-010	WASHER ST.ST. 3.2	32
3023-006	WASH LOCK ST.ST. M3	33
4509-170	INSULATION BLOCK	34
4802-256	PLATE	35
6001-469	REFERENCE PHOTO DIODE UNIT	36

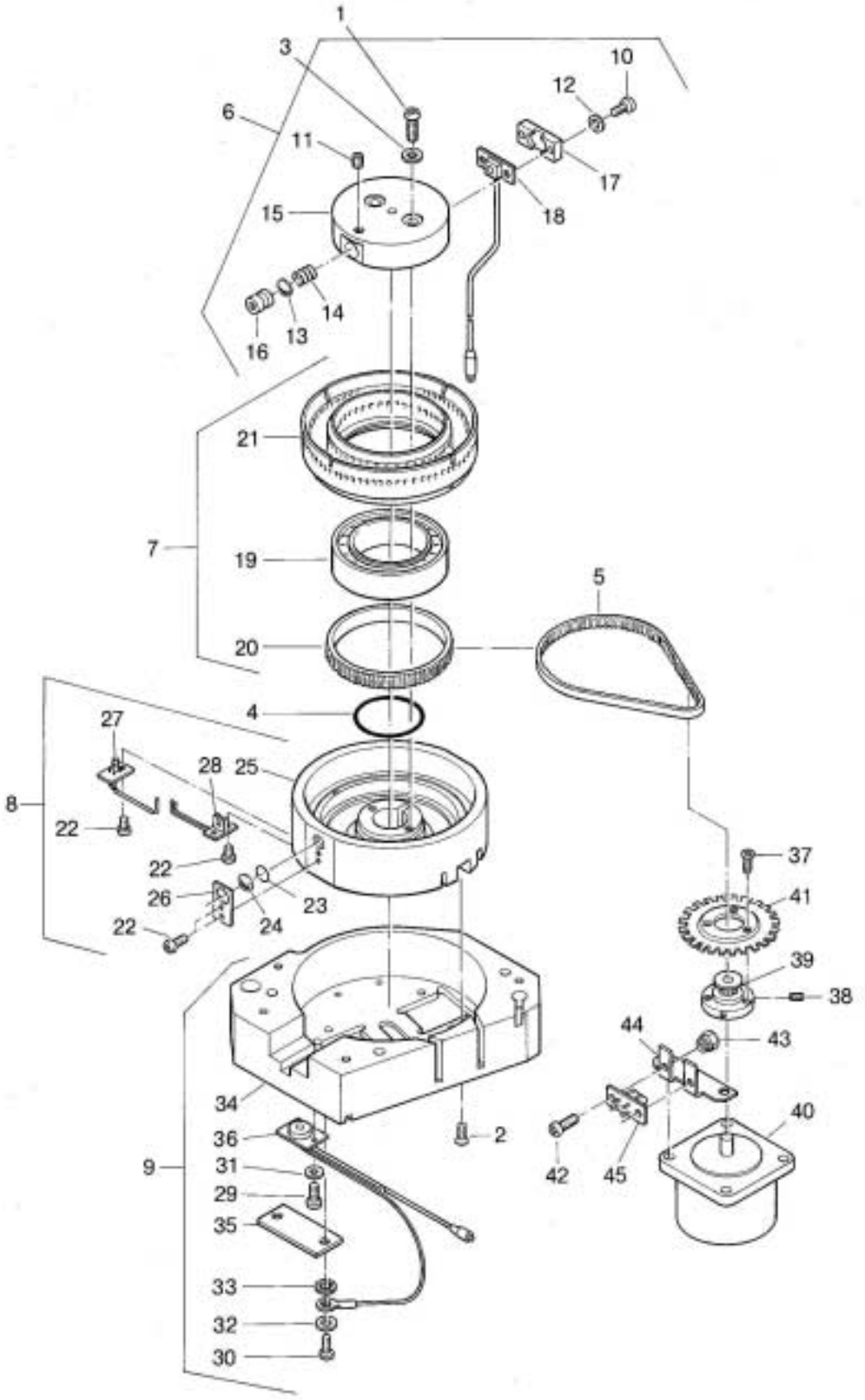
ENCODER STEPPER MOTOR UNIT 6001- 430

PART NUMBER	DESCRIPTION	LOCATION
3004-204	SCREW ST.ST M2X6	37
3008-040	SCREW ST. M4X5	38
3130-076	SPROCKET T2,5/15	39
3363-505	STEPPER MOTOR	40
4700-543	ENCODER DISC	41

ENCODER OPTO UNIT ROTORS 6001- 930

PART NUMBER	DESCRIPTION	LOCATION
3002-016	SCREW ST.ST. M3X6	42
3019-011	NUT INSERT ST. M3	43
4803-472	BRACKET	44
6001-900	ENCODER OPTO BOARD	45

MAIN ASSEMBLY MEASURING UNIT



LAMP HOLDER MOUNTING PLATE ASSEMBLY 6001- 884

PART NUMBER	DESCRIPTION	LOCATION
3002-015	SCREW ST.ST. M3X4	1
3002-016	SCREW ST.ST. M3X6	2
3002-027	SCREW ST.ST. M4X10	3
3004-226	SCREW ST.ST. M4X8	4
3022-015	WASHER ST.ST. 4.3	5
3023-006	LOCKWASHER	6
3060-053	LENS 08	7
3750-035	SPRING	8
4102-239	EXCENTER	9
4105-195	BUSH	10
4502-293	BEAM	11
4802-257	PLATE	12
4802-343	PLATE	13

LAMP HOLDER UNIT 6001- 461

PART NUMBER	DESCRIPTION	LOCATION
3002-016	SCREW ST.ST. M3X6	14
3002-027	SCREW ST.ST. M4X10	15
3023-006	LOCKWASHER	16
3023-010	WASH.LOCK,ST.ST.M4	17
3350-008	CONN. SOLDER PIN CONTACT	18
3350-156	CONNECTOR LAMPSOCKET	19
3372-525	WIRE 7X0.4 WHITE	20
3380-018	Q.I.LAMP 12V-20W	21
4502-292	BEAM	22
4803-441	BRACKET	23

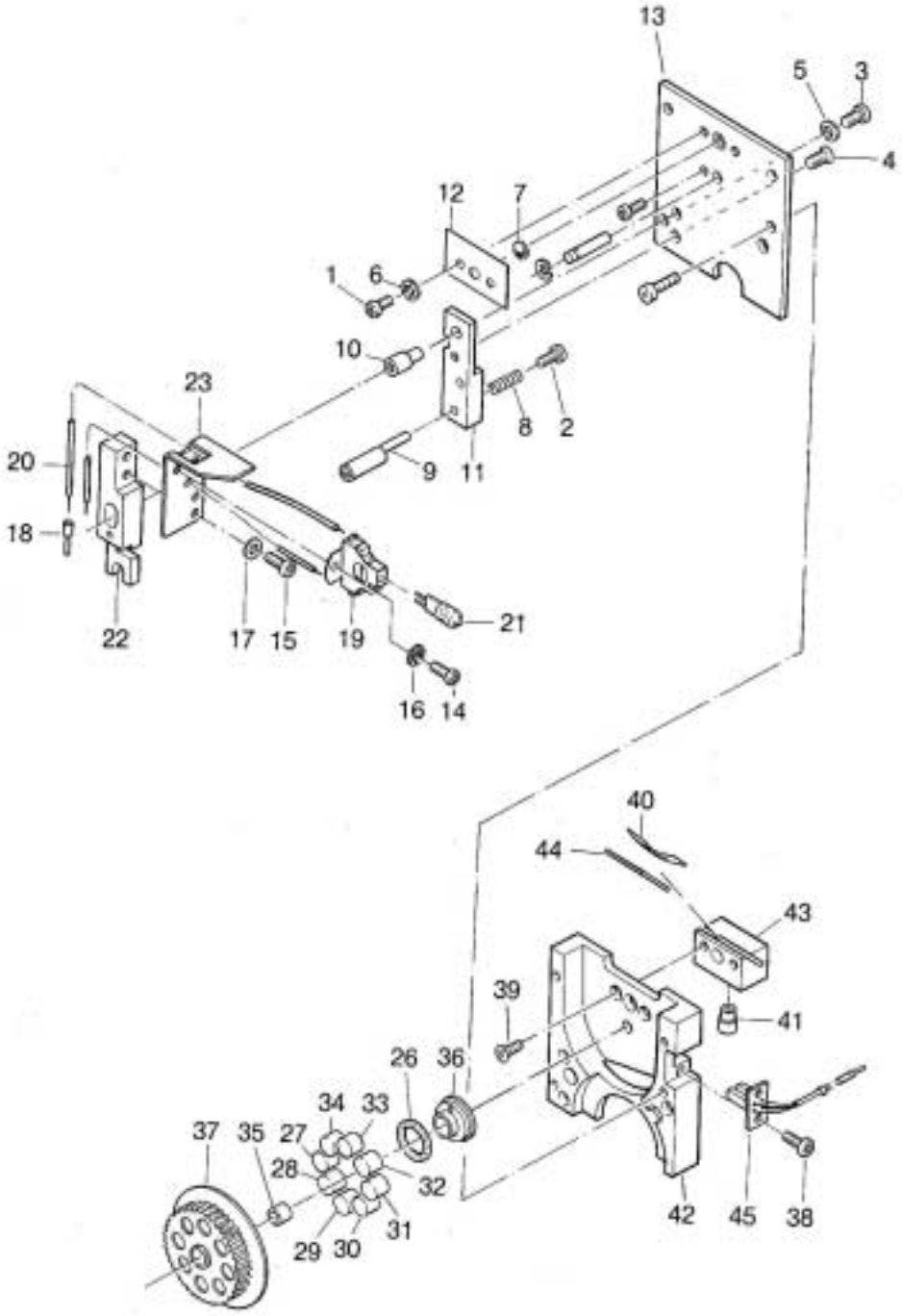
FILTER WHEEL WITH FILTERS 6001- 460

PART NUMBER	DESCRIPTION	LOCATION
3029-041	O-RING	26
3067-340	IFL FILTER 340 nm	27
3067-376	IFL FILTER 376 nm	28
3067-405	IFL FILTER 405 nm	29
3067-436	IFL FILTER 436 nm	30
3067-505	IFL FILTER 505 nm	31
3067-546	IFL FILTER 546 nm	32
3067-578	IFL FILTER 578 nm	33
3067-620	IFL FILTER 620 nm	34
3106-031	BEARING 5x8x10	35
4106-214	RING FOR FILTERWHEEL	36
4700-540	FILTERWHEEL	37

BEAM SPLITTER BOARD 6001- 818

PART NUMBER	DESCRIPTION	LOCATION
3002-016	SCREW ST.ST. M3X6	38
3004-226	SCREW ST.ST. M4X8	39
3059-015	WINDOW	40
4105-194	BUSH	41
4501-533	BLOCK	42
4509-124	BS BLOCK	43
4752-044	LEAF SPRING	44
6001-819	FILTER RESET BOARD	45

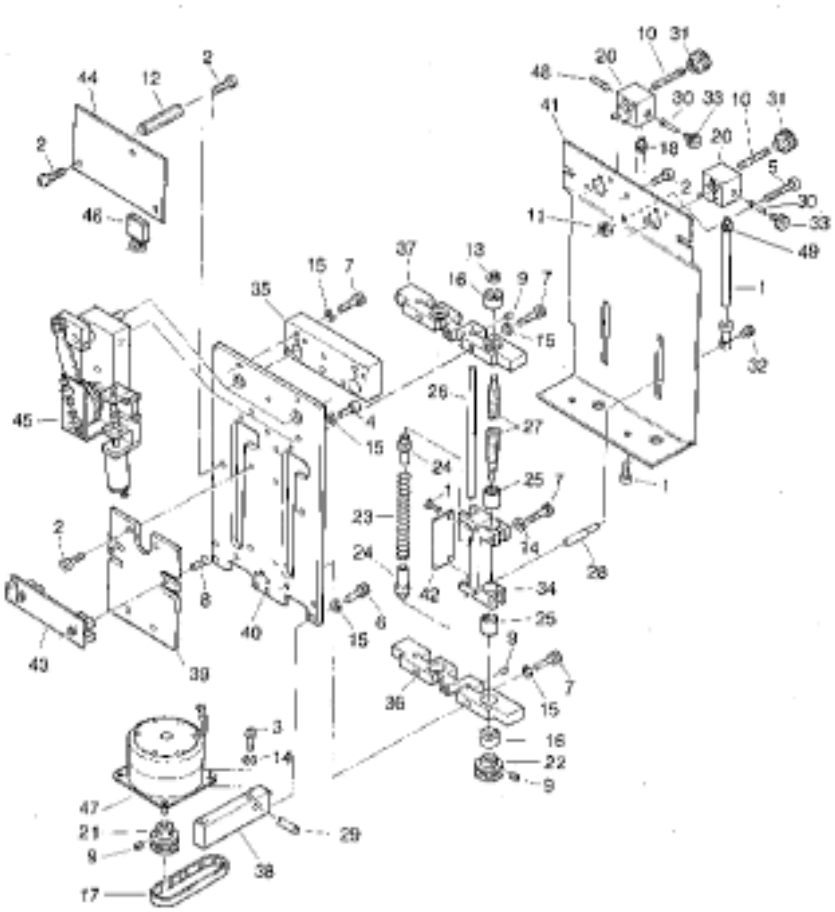
MOUNTING PLATE ASSY
LAMP UNIT
FILTER WHEEL WITH FILTERS
BEAM SPLITTER BOARD

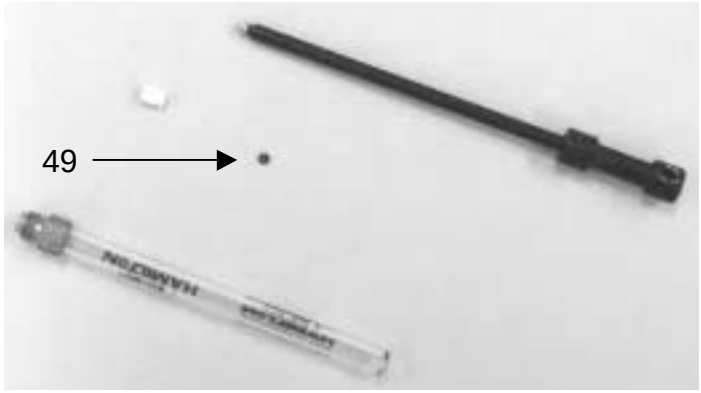


PIPETTOR UNIT 6001- 754

PART NUMBER	DESCRIPTION	LOCATION
3002-016	SCREW ST.ST. M3X6	1
3002-018	SCREW ST.ST. M3X8	2
3002-026	SCREW ST.ST. M4X8	3
3002-029	SCREW ST.ST. M4X16	4
3002-032	SCREW ST.ST. M4X35	5
3002-333	SCREW ST.ST. M4X12	6
3002-336	SCREW ST.ST. M4X16	7
3004-211	SCREW ST.ST. M3X8	8
3008-040	SCREW ST.ST. M4X5	9
3008-048	SCREW RVS M5X40	10
3011-016	NUT ST.ST. M4	11
3019-048	NUT M3X45	12
3020-017	CIRCLIP 4	13
3022-015	WASHER ST.ST. 4.3	14
3023-010	WASH.LOCK,ST.ST.M4	15
3053-001	BEARINGBALL 6X19X6	16
3064-016	BELT TIMING 80T T2.5	17
3066-070	SYRINGE 1ml	18
3066-071	SYRINGE 100µl	19
3066-072	VALVE DISPENSER UNIT	20
3130-069	SPROCKET T2,5/24	20
3130-070	SPROCKET T2.5/25	22
3750-033	SPRING	23
4100-410	BUSH FOR GUIDE SHAFT	24
4100-411	DRIVE NUT	25
4102-304	GUIDE SHAFT	26
4102-305	LEAD SCREW	27
4102-306	DRIVE PIN	28
4102-344	SHAFT	29
4105-215	BUSH	30
4107-065	KNOB FOR VALVE BLOCK	31
4107-066	KNOB FOR SYRINGE PLUNGER	32
4107-079	SCREW	33
4501-424	CARRIAGE	34
4501-487	BLOCK	35
4502-334	BEAM	36
4502-335	BEAM	37
4502-356	STRIP	38
4509-132	PLATE	39
4509-169	PLATE	40
4509-180	PLATE	41
4802-227	VANE ON CARRIAGE	42
6001-459	DISPENSER OPTO BOARD	43
6001-769	DISPENSER DRIVER BOARD	44
6001-780	VALVE DRIVE UNIT	45
6001-812	VALVE MOTOR CABLE	46
6001-813	STEPPERMOTOR DISPENSER	47
4105-214	BUSH DILUTER VALVE	48
3916-030	RING	49

PIPETTOR UNIT

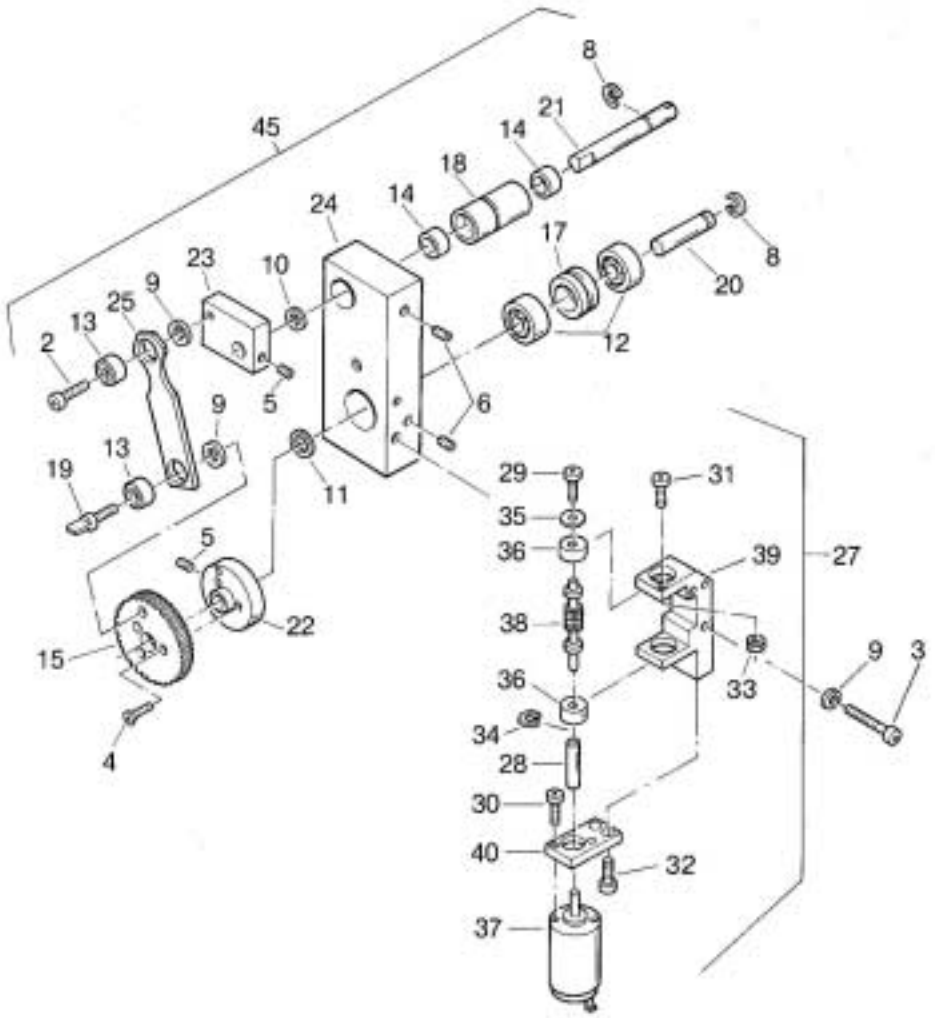




VALVE DRIVE UNIT 6001-780

PART NUMBER	DESCRIPTION	LOCATION
3002-019	SCREW ST.ST. M3X10	2
3002-023	SCREW ST.ST. M3X20	3
3004-205	SCREW ST.ST. M2X8	4
3008-040	SCREW ST.ST. M4X5	5
3008-041	SCREW ST.ST. M4X5	6
3020-017	CIRCLIP 4	8
3022-010	WASHER ST.ST. 3.2	9
3022-018	SHIM RING	10
3022-023	SHIM RING	11
3053-001	BEARINGBALL 6X19X6	12
3053-002	BEARINGBALL 3X10X4	13
3053-019	BEARINGBALL 5X11X4	14
3130-062	GEAR	15
4100-408	BUSH	17
4100-409	BUSH	18
4102-269	SHAFT	19
4102-302	SHAFT	20
4102-303	SHAFT	21
4106-203	DISC	22
4501-422	BLOCK	23
4501-519	BLOCK	24
4803-297	STRIP	25
6001-781	MOTOR UNIT U/D MOVEMENT	27
1513-001	PVC TUBE R.2X4 CL.	28
3002-001	SCREW ST.ST. M2X4	29
3002-003	SCREW ST.ST. M2X6	30
3002-016	SCREW ST.ST. M3X6	31
3002-307	SCREW ST.ST. M3X8	32
3011-011	NUT ST.ST. M3	33
3020-011	CIRCLIP 2.3	34
3022-005	WASHER ST.ST. 2.2	35
3053-002	BEARINGBALL 3X10X4	36
3363-620	MOTOR 12V,ESCAP	37
4102-243	WORM	38
4501-518	BLOCK	39
4802-329	PLATE MOTOR U/D MOV.	40

VALVE DRIVE UNIT



HEAT EXCHANGER REAGENT ROTOR 6001- 797

PART NUMBER	DESCRIPTION	LOCATION
3002-029	SCREW ST.ST. M4X16	1
3002-021	SCREW ST.ST. M3X16	1A
3002-025	SCREW ST.ST. M3X30	2
3002-031	SCREW ST.ST. M4X20	3
3002-034	SCREW ST.CAD M4X45	4
3002-322	SCREW ST.ST. M3X40	5
3004-216	SCREW ST.ST. M3X20	6
3009-019	SCREW M8x30 POL.	7
3011-028	NUT M8 POLYAM.	8
3066-081	TUBE PILLAR M10x1keg	9
4501-497	BLOCK	10
4501-499	BLOCK	11
4509-158	BLOCK	12
4801-105	PLATE	13
4801-106	PLATE	14
4801-107	PLATE	15
4801-108	PLATE	16
4801-109	PLATE	17
4802-298	PLATE	18
4802-299	PLATE	19
4802-300	INSULATION PLATE	20
4802-301	PACKING	21
6001-393	BLOCK ASSY	22
6001-796	FAN COOLUNIT	23
6001-396	BLOCK ASSY	24
6001-798	SINK ASSY	25

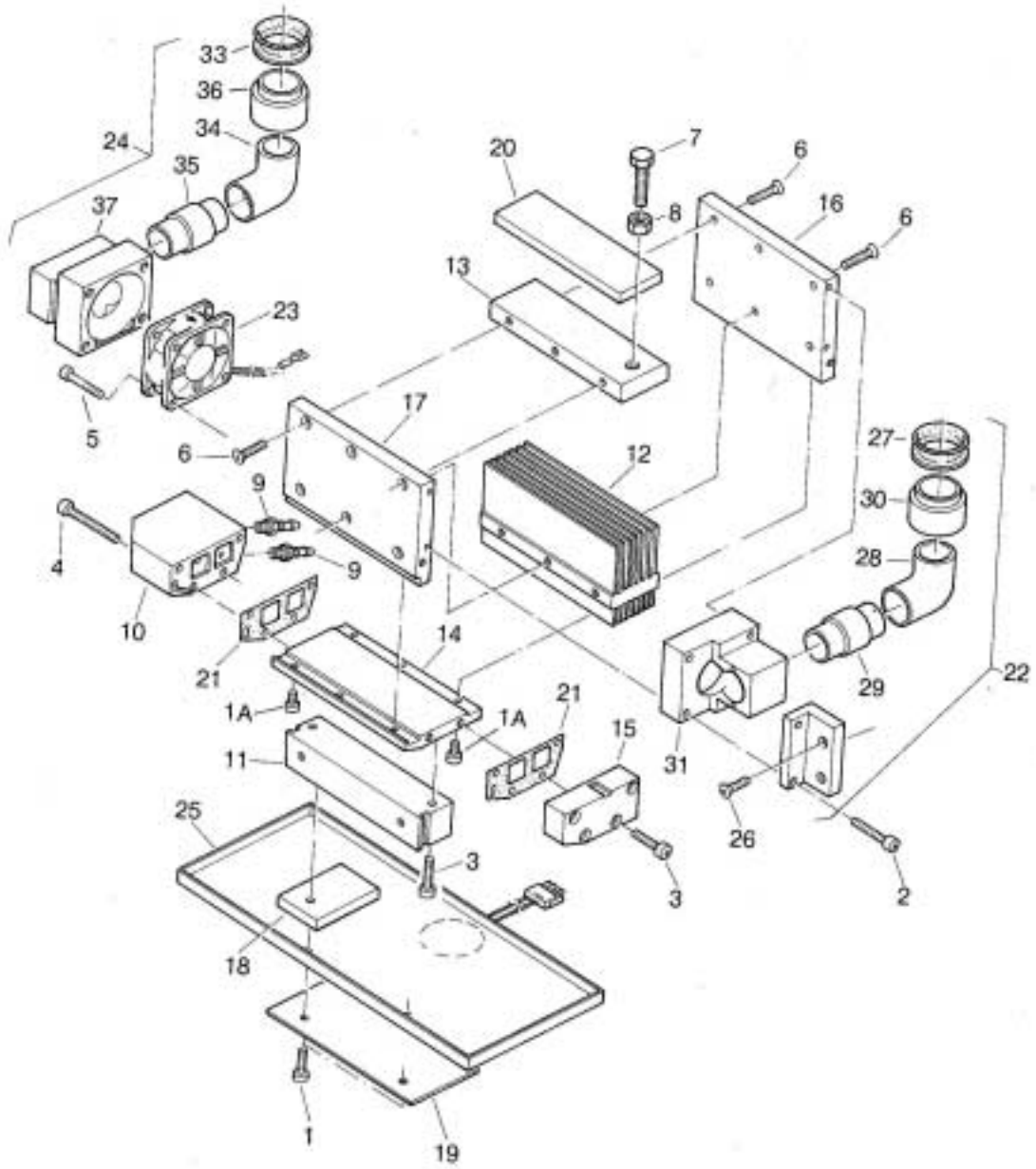
BLOCK ASSY 6001- 393

PART NUMBER	DESCRIPTION	LOCATION
3004-215	SCREW ST.ST.	26
3029-050	V-SEAL RING	27
3066-073	PVC KNEE	28
4105-223	BUSH	29
4105-224	BUSH	30
4501-490	BLOCK	31
4501-498	BLOCK	32

BLOCK ASSY 6001- 396

PART NUMBER	DESCRIPTION	LOCATION
3029-050	V-SEAL RING	33
3066-073	PVC KNEE	34
4105-223	BUSH	35
4105-224	BUSH	36
4501-463	BLOCK	37

HEAT EXCHANGER REAGENT ROTOR
BLOCK ASSY
BLOCK ASSY



DILUTED WASTE CONTAINER 6001- 826

PART NUMBER	DESCRIPTION	LOCATION
1513-002	PVC TUBE R. 4X6 CLEAR	1
3004-211	SCREW ST.ST. M3X8	2
3066-094	CONNECTOR	3
3066-105	NUT RED	4
3344-015	SWITCH.LIQUID.LEVEL	5
3351-028	3P CABLE CONN.	6
3370-727	SLEEVE CODE "7" YELLOW	7
3370-728	SLEEVE CODE "8" YELLOW	8
3820-261	STICKER	9
3820-265	STICKER	10
4100-497	10 L CONTAINER	11
4100-668	PROP	12
4100-669	CAP	13
4104-104	PIPE	14

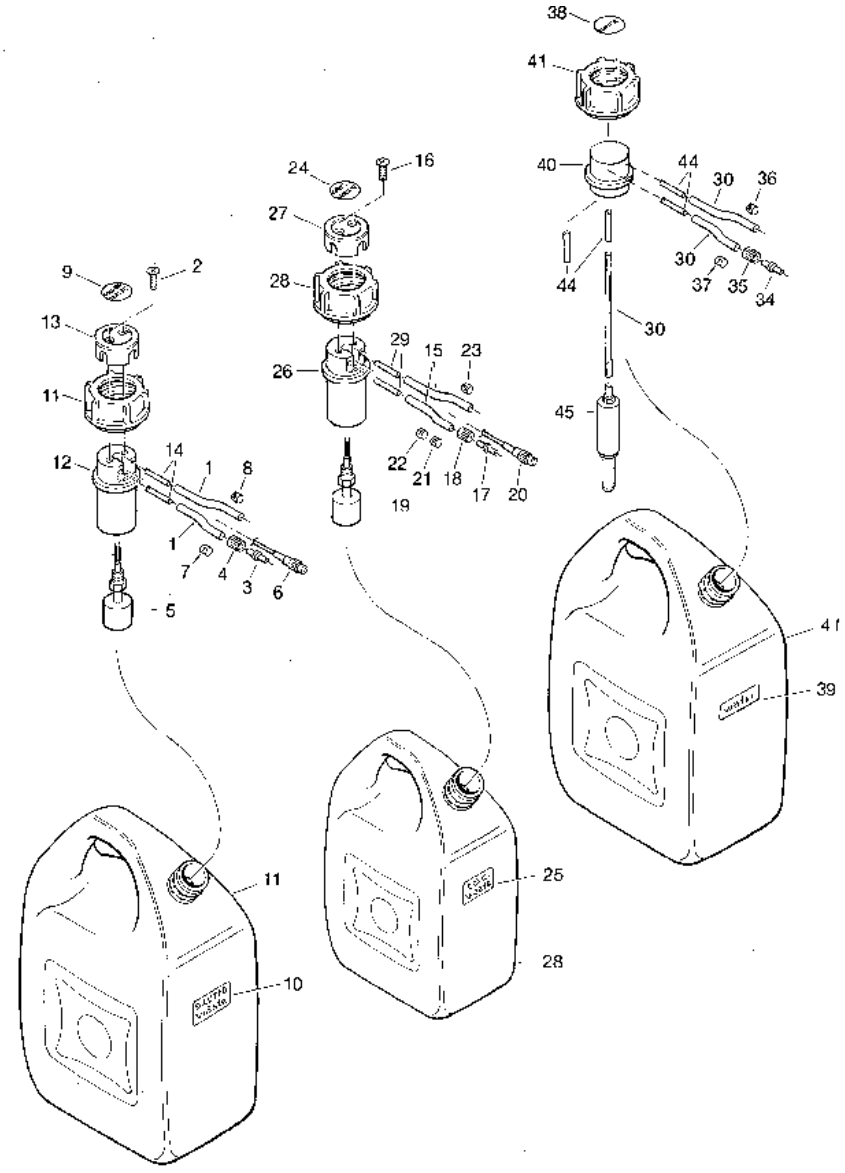
CONCENTRATED WASTE CONTAINER 6001- 827 (OPTIONAL)

PART NUMBER	DESCRIPTION	LOCATION
1513-002	PVC TUBE R. 4X6 CLEAR	15
3004-211	SCREW ST.ST. M3X8	16
3066-094	CONNECTOR	17
3066-105	NUT RED	18
3344-015	SWITCH.LIQUID.LEVEL	19
3351-028	3P CABLE CONN.	20
3370-720	SLEEVE CODE "0" YELLOW	21
3370-721	SLEEVE CODE "1" YELLOW	22
3370-729	SLEEVE CODE "9" YELLOW	23
3820-260	STICKER	24
3820-264	STICKER	25
4100-668	PROP	26
4100-669	CAP	27
4100-670	CONC. WASTE CONTAINER	28
4104-104	PIPE	29

WATER CONTAINER 6001- 860

PART NUMBER	DESCRIPTION	LOCATION
1513-001	PVC TUBE R2X4	30
3066-093	CONNECTOR	34
3066-107	NUT BLUE	35
3370-736	CODEMARKER “5”	36
3370-737	CODEMARKER “6”	37
3820-262	LOGO	38
3820-266	STICKER	39
4100-703	PROP	40
4100-497	CONTAINER	41
4104-080	PIPE	44
6001-620	WATERFILTER	45

DILUTED WASTE CONTAINER
CONCENTRATED WASTE CONTAINER (OPTIONAL)
WATER CONTAINER



9.2 SPARE PARTS

This chapter contains the spare parts that can not be found in the exploded views.

Power supply:

The power supply can only be exchanged as a whole.
There are no separate spare parts available for the power supply.

3359 – 039 power supply

Fan:

6001 – 847 fan incl. connector

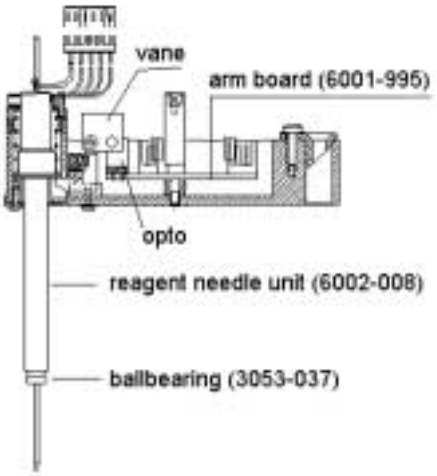
Cooling unit:

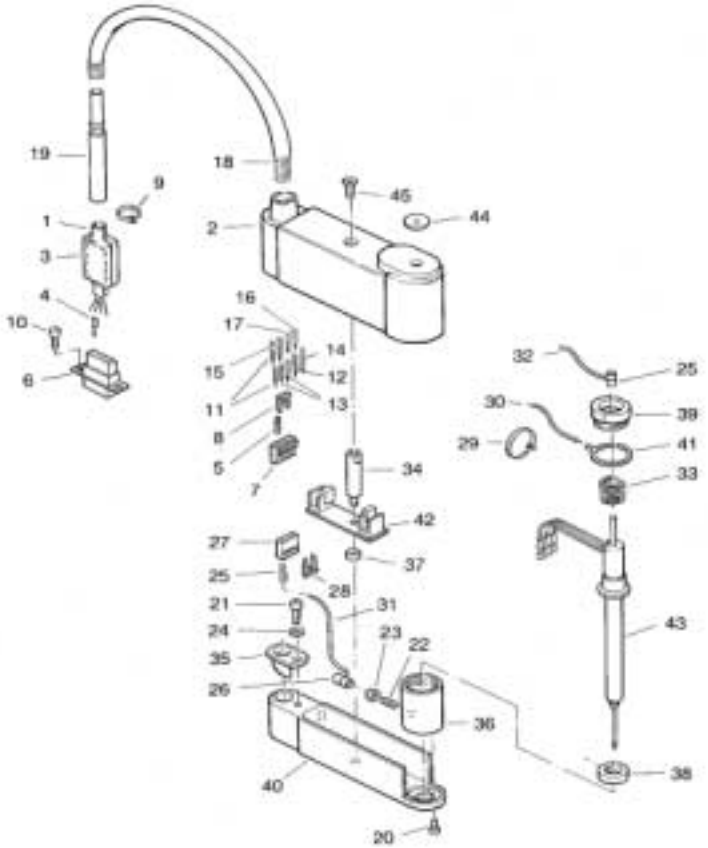
2206 – 007 cooling liquid
3913 – 034 pump 230V / 50Hz
3913 – 035 pump 115V / 60Hz
3913 – 045 pump 220V / 60Hz
3913 – 046 pump 110V / 50Hz
3913 – 036 impeller 50 Hz pump
3913 – 037 impeller 60 Hz pump
3913 – 100 temperature control unit
3913 – 101 transformer 230 V / 12 V
3913 – 102 transformer 115 V / 12 V
3913 – 103 hosecoupling 90°
3913 – 104 hosecoupling 180°

Optional parts:

See product guide

Reagent arm:





Sample arm: